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[OFFICIAL NOTICE.]

Appointment of a Committee of Reception by the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY,
PROVIDENCE, R. I., June 5th, 1893.

The following named members of this Association are appointed and respectfully requested to serve as a Committee of Reception, whose duty shall be to call upon all foreign gas engineers visiting our country during the continuance of the World's Fair at Chicago, whose names and addresses may be obtained, and to introduce them to other members of our profession, see that they obtain permits to visit the neighboring gas works and other objects of interest, and generally to make their stay in New York as pleasant as possible, and when they leave for Chicago, to give them letters of introduction to the Committee of Arrangements at Chicago: Messrs. Wm. Henry White (chairman), Eugene Vanderpool, William H. Bradley, Fred. S. Benson, William R. Beal, Jos. R. Thomas, Thos. F. Rowland, Jr., Fred. W. Floyd and Oscar Weber.

The Guild of Gas Managers and the Society of Gas Lighting are respectfully requested to co-operate with this committee in extending hospitality to our visiting professional brethren.

A. E. BOARDMAN, President.

A. B. SLATER, JR., Secretary.

[OFFICIAL NOTICE.]

The American Gas Light Association's Greeting to European Gas Engineers.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY,
PROVIDENCE, R. I., June 5th, 1893.

To the European Gas Engineers—Greeting: The American Gas Light Association will hold its 21st annual convention in the city of Chicago, beginning on the date of Wednesday, October 18th, 1893. It would give the members of the Association great pleasure to meet there as many of the European gas engineers and managers as can make it convenient to be in attendance at the World's Fair at that time. It is suggested that all contemplating visiting the Fair arrange their visits so as to be in Chicago, if possible, at the time of this convention, when they will be most cordially welcomed by the Association and invited to attend the sittings of the body and participate in its discussions of papers presented.

Those engineers who cannot conveniently visit the World's Fair at that time, but must choose some other date, are respectfully requested to send their names and addresses, as soon as they arrive in America, to the AMERICAN GAS LIGHT JOURNAL, No. 32 Pine street, New York City, so that a committee from the Association may be made aware of their presence, and when they may be met, so that they may form the acquaintance of their professional brethren in this country and be made to feel less like a "stranger in a strange land."

A. E. BOARDMAN, President.

A. B. SLATER, JR., Secretary.

BRIEFLY TOLD.

MR. PERRINE'S PRETTY PICTURING AS TO "ELECTRICITY IN THE HOME AND OFFICE."—In our issue of last week (pp. 220-222), we reprinted an article, written for *Engineering Magazine*, by Mr. Frederic A. C. Perrine, entitled "Electricity in the Home and Office," which article is well written, even if its stated facts are well wide of the truth. We do not know much—indeed we do not know anything about the standing enjoyed by Mr. Perrine in the engineering world in general, or the electrical engineering field in particular; but it seems to be so that one would not err in generally assuming that Mr. Perrine is an enthusiast when he addresses himself to topics electrical. The pleasing picture which he draws of that modern mansion where everything is done by means of the electric current is, however, sadly overdrawn—the coloring is fairly splashed on—and the net result of a reading of the article is the creating of a feeling that one has been passing an hour or so in the realms of a romancist. In one's hours of ease, of course, this is all right—one must have relaxation; but in the other and greater number of hours, which we are obliged to put in in the gathering of that knowledge that enables us to take the hours of ease, the "engineering" trash of the Perrine order is anything other than palatable or profitable. Far be it from us to decry the solid advances made by earnest, hardworking electrical engineers in the past decade, and equally remote is our intention of decrying the splendid results and the advantages to the everyday world that are traceable to the developments of the generation and distribution of electrical currents; but what we do most earnestly protest against is the extravagant unreasoning, the ridiculous assertion that many self-constituted electrical engineers indulge in. From Prof. Preece down, it would seem that every electric enthusiast, no matter how sane he may be on all other topics, who permits himself to put together anything on paper to be read by others respecting the past, present and future of the electric current, becomes as vague and vainglorious in his description and prophecies as the current about which he dilates is mysterious and undiscoverable. Mr. Perrine lays great stress and store on the beauties and perfectness of electric heat, both for the warming of apartments and the cooking of food, whereas this branch of commerce in electricity is positively and absolutely nil. No doubt, Mr. Perrine's home and office electrical outfit and the operation thereof constitutes a very pretty story, and would be most enjoyable to contemplate in reality; but the trouble is that one cannot enjoy the reality, for the reality does not exist. The reverse of the thing may be taken something after this style. Pretty nearly *everything* that he fancies could be done is being done at present by gas. The home and the office are lighted by gas, the living apartments and the cooking room are heated and is operated by the product of the gas works; and, best of all, the work is performed at a cost that places the medium within reach of the resources of all—the humblest of the "boss' men" as well as the "boss" himself. Mr. Perrine's mythical hostess and her other self, the "boss," presumably having an unlimited supply of the funds which can bring to their aid and support "all the comforts of home," may reasonably and safely indulge to their hearts' content in all the newest fads; but their employees—and for the one employer there are hundreds of employees—must look to the cost and general utility of that which they have to pay for in making their homes comfortable and themselves contented. So it goes that the hundreds will use gas for lighting, heating and cooking where the one will give his adhesion to the mysterious agent that speeds from the dynamo; and we are close to the mark in saying that the hundreds will be *better* and far *more cheaply* served than will the one. After all, it is a question of comparative service and the cost thereof, and until the electrician overcomes the waste that teems in his various conversions of power, from the moment the coal goes into the furnaces to the point where the current is converted into useful work will the product of the gas works hold the field as the choice of the multitudes in their demands for a cheap and reliable lighting, cooking, heating and power agent.

NOTES.—The residents of Stroudsburg, Pa., have complained to the State Fish Commissioners that the refuse from the local gas works has polluted Broadhead's Creek to such a degree that thousands of trout in the waters thereof were killed. The proprietors of the works assert that other factories on the line of the creek are responsible for the pollution, and the Fish Commission have the matter under investigation.——Articles have been filed with the County Recorder showing the recent consolidation of the Mount Pleasant (Ia.) Gas Light Company and the local electric lighting concern. The gentlemen most largely interested in the combined enterprise are Messrs. G. H. Spahr, H. E. Snider, Henry Ambler and W. S. Fletcher. The capital stock has been placed at $72,000, and a new electric lighting station will be constructed on a site close to the gas works.—Cassius P. Taylor and others recently obtained an injunction restraining the Edison Electric Light Company, of Detroit, Mich., from extending its plant, which is located on Woodward near Willis avenues, that city, the basis of the injunction being the claim that the present plant was a nuisance owing to the noise that emanated therefrom.

The Principles of the Production of Illuminating Gas from Liquid Hydrocarbons.

[A Paper read by Mr. WILLIAM YOUNG, before the North British Association of Gas Managers.]

Owing to the enormous supplies of high-quality natural petroleum oil, our native industry of artificially producing mineral oil from shale by destructive distillation has lately suffered severely; more particularly in respect to that part of the distillate of the paraffine oil having a high specific gravity, which was manufactured into lubricating oil, and especially where the shales necessarily produced oils of low viscosity. So much was this the case that in several works they were almost unmarketable, and were used as fuel under the steam boilers.

Many attempts had been made to employ those oils of high specific gravity for the production of illuminating gas; but, owing to the high percentage of carbon in their constitution, they gave so much trouble from sooty, pitchy deposits in the gas producing apparatus that they could not be economically used by existing commercial processes.

At the instigation of Mr. John Fyfe, of Young's Paraffine Light and Mineral Oil Company, I, with the assistance of Mr. Bell, made a series of experiments with the view of discovering some method of manufacturing illuminating gas from such heavy oils without the accompanying inconveniences. Mr. Bell is to read to you to day a paper upon the process which has been the practical outcome of these experiments; and I thought I might usefully premise his paper by a few remarks upon the principles relating to the production of gas from oil, more particularly those which guided us in our experimental work.

I have on several previous occasions given to this, and to the Association now merged in it, my views, and the results of experiments relating to the principles of the production of illuminating gas, more particularly from coal and shale. These earlier papers, however, apply to, and embody most of, the principles which have formed the basis of our experiments in producing illuminating gas from heavy hydrocarbon fluids. I would therefore refer you back to those prior communications for details; dealing on the present occasion only with broad principles, and taking them in the following order:

A. The manner in which heat acts upon hydrocarbon vapors in bringing about their decomposition into gaseous compounds.
B. The conditions modifying the decomposing action of heat: (1) temperature; (2) time occupied in effecting decomposition; and (3) atmosphere in which decomposition is effected.
C. Constitution of the resulting compound, due to those various causes, in relation to the greatest illuminating power obtainable in the form of gaseous compounds from a given quantity of hydrocarbon fluid.

At a meeting of the West of Scotland Association, held at Kilmarnock in September, 1878, and again at a meeting of this Association, held at Perth in July, 1880, special reference was made to the manner in which heat acts upon hydrocarbon vapors. The theory then advanced was: That heat acts in two ways—first, by direct contact between the molecules of the hydrocarbon vapors and the heated surfaces in the retort; and, second, as radiant heat upon the molecules of the hydrocarbon vapor in the space over the coal. That there is an essential difference in the products from a given hydrocarbon, dependent upon whether the decomposition is effected by heat communicated by contact or by heat in the radiant form. That surface contact leads to an indiscriminate shattering of the hydrocarbon vapors, or, at least, to the production of a different class of compounds from those which are produced by the action of radiant heat. That radiant heat does not act upon a complex mixture of hydrocarbon vapors indiscriminately; but that the waves of heat from the walls of the retort are selective, passing freely through the elementary gases and simple vapors, but acting more and more vigorously upon the molecules of the hydrocarbon the higher their complex structure, leading to their decomposition into simpler bodies.

Practical experience in many operations bears evidence that there is some truth in the theory. For instance, the effect of surface contact in bringing about an indiscriminate shattering of hydrocarbon vapors was well illustrated in the Malam process; and also in the case of one of my early attempts, along with the late Mr. Scott, of Musselburgh, to improve the system of carbonizing coal. By both arrangements the volatile hydrocarbon vapors and gases coming from the coal were passed through a mass of incandescent coke; with the like results—viz., the shattering of the hydrocarbon vapors into a large volume of almost non-luminous gases and a quantity of sooty pitch, which gave an endless amount of trouble, from the choking up of the apparatus.

These two processes were repeats in principle of a legion of like pro-

cesses that had gone before, including those oil-gas processes where the decomposition of oil in the production of gas was brought about by red-hot surfaces. They all failed from a like cause.

The action of radiant heat upon hydrocarbon vapor in free space is illustrated when retorts are worked with light charges, leaving a considerable empty space over the coal. There is little doubt that the superior results obtained under such circumstances are, to a large extent, due to the selective action of radiant heat acting upon the complex hydrocarbon molecules; decomposing them and leaving the simpler hydrocarbons unaffected. I have no doubt the same remarks apply to what is known as the Dinsmore process, where the hydrocarbons produced from a series of retorts are made to pass through what is called an empty duct; and that any improved result obtained is due to a like cause.

In short, out of the very large number of systems of carbonizing coal or oil for the production of illuminating gas, none of them have proved successful that had not a vacant space in which radiant heat could act upon the hydrocarbon vapors.

In the early days of the shale-oil industry, horizontal retorts (in which there was a considerable empty space left) were employed for the destructive distillation of the shale. The resulting oil was small in quantity, had a low specific gravity, contained a large percentage of hydrocarbon having a low boiling-point and a small quantity of the solid paraffines; and there was produced a large volume of illuminating gas. All these results points to the effects of radiant heat upon the hydrocarbon vapors in the empty space over the shale in the retort. When vertical retorts came to be used, in which the shale completely filled the retort, the resulting oil was larger in quantity, higher in specific gravity. contained a considerably larger percentage of the solid paraffines and less of the oil having a low boiling point; and the make of gas was considerably less—all pointing to a smaller decomposition of the hydrocarbon vapors from the shale.

The object of the shale-oil distiller is to conserve the hydrocarbon constituents of the shale in the liquid form; and he has abandoned every form of retort that had a free space in which radiant heat could act upon the hydrocarbon vapors. Even in the subsequent distillation of the oils in the process of refining, it was observed that a considerable amount of decomposition took place; that there was produced a considerable volume of permanent gas; and that the greater the free space in the still over the oil the greater was the destructive decomposition. When the process of distilling the oil was made continuous, running in the oils into the still at the same rate that they distilled off, keeping a very small free space in the still over the oil, the decomposition was reduced to a minimum.

On the other hand, the decomposing action of radiant heat in the vacant space in the still was utilized in the cracking up of some of the heavier oils, which had a low market value, into lighter oils of greater value. To accomplish this object large stills were employed. Only the bottom of the still exposed to the fire was covered with the low-priced oil to be decomposed; and the temperature applied was just sufficient to slowly volatilize the oil into the vacant space, where the vapor, exposed to the radiant heat, was slowly decomposed into more volatile oils, which passed from the still to the condenser. In some cases a fractionating arrangement was placed between the still and condenser, by which that portion not sufficiently cracked up was continuously returned to the still, to undergo further decomposition.

The decomposing action of heat upon a hydrocarbon vapor may be considerably modified by a number of conditions: The temperature, the time which the hydrocarbon is exposed to the decomposing action of the heat, and (in the case of some of the processes by which illuminatting gas is produced from hydrocarbon fluid) the atmosphere in which the decomposition is effected. The factors of time and temperature are well illustrated in the process of cracking up the heavy hydrocarbons into lighter hydrocarbons to which I have just alluded. We then saw radiant heat of very low temperature applied for a long time bringing about the cracking up of the complex molecules of the heavier oils into the simpler molecules of lighter oils suitable for the manufacture of lamp oils. The same result could not be obtained by a shorter exposure of the vapors of the heavier hydrocarbons to a higher temperature. Higher temperatures applied for a shorter period of time in a smaller free space would produce a different class of products altogether. The action of heat under the two conditions may be likened to that of gunpowder and dynamite in blasting rock. The comparatively slow explosion of gunpowder would simply tear the rock into large masses suitable for building purposes. Dynamite, on the other hand, would shatter the rock into useless fragments.

I during the process of cracking the heavy oils, the conditions were modified by admitting an atmosphere of dry steam into the free space in the still, amongst the hydrocarbon vapors, the cracking up of the vapors would cease, because the molecules of steam would take up a part of the molecular motion of the hydrocarbon vapor imparted to it by the radiant heat, and prevent it, so to speak, being shaken to pieces to form the simpler molecules of lighter oils. Steam under such conditions has a protective action. If, however, on the other hand, the mixed water and hydrocarbon vapor was exposed for a short period of time to a temperature sufficiently high to decompose the water vapor in the presence of the hydrocarbon vapor, then natural decomposition would take place; the oxygen of the water vapor going to the hydrocarbon—setting free hydrogen and producing hydrocarbon gases and vapors and carbonic acid or carbonic oxide, in varying quantities, dependent on the temperature.

Various processes for the production of illuminating gas from hydrocarbon fluids based upon the reaction between steam and a hydrocarbon vapor have been tried; the desired object being the utilization of the surplus carbon present in all, and particularly in heavy oils to produce water gas to dilute the rich hydrocarbon gas. Had it proved possible to confine the action between the steam and the hydrocarbon vapor to the purely surplus carbon, the process would have been an ideal one. Unfortunately, however, at the instant of mutual decomposition, the oxygen of the steam does not confine its operation to the surplus carbon, but goes direct at the hydrocarbon, bringing about the destruction of a large quantity of illuminating matter. Besides, the carbonic oxide produced has a destructive effect upon the illuminating constituents present in the gas, probably due to the combustion of the carbonic oxide taking place simultaneously with that of the illuminating gases; or even remaining unconsumed until the hydrocarbon has been partially decomposed, and only being consumed in the upper part of the flame—thus acting in the illuminating part of the flame as an inert gas.

These remarks also more or less apply to the production of illuminating gas by injecting or combining a hydrocarbon fluid with coal during the process of carbonizing. Undoubtedly the large volume of hydrogen and marsh gas present has the effect, to some extent, of protecting from over decomposition the hydrocarbon vapor. The water vapor, however, which is more or less present, leads, by its interaction with the hydrocarbon vapor, to considerable loss in illuminating power. There is also little doubt that the very large heating surface and comparatively small free space lower the total illuminating value got from a given quantity of hydrocarbon fluid. When shale is carbonized direct for the production of gas, the volatile hydrocarbon products are decomposed in the presence of the water vapor simultaneously eliminated from the shale. The largest illuminating power obtainable under such conditions will not exceed 40 candles. If the same shale is distilled at a temperature sufficiently low to prevent, to a large extent, the interaction between the water and hydrocarbon vapor, so as to produce mineral oils, and these oils isolated from the water and subjected to decomposition, gas having an illuminating value twice as great as that got from the direct carbonizing of the shale is easily obtained; thus showing the great deteriorating effect of the presence of water vapor during the decomposition of a hydrocarbon vapor into illuminating gas.

On the other hand, in the class of processes where illuminating gas is produced by decomposing hydrocarbon vapor in an atmosphere of water gas, a high temperature can be employed to do the work of decomposition, as the effects of the heat are very much modified by the molecules of the inert gas taking up part of the motion communicated to the hydrocarbon vapor by the radiant heat; acting as a cushion in preventing the shattering action of heated surfaces. It requires, however, careful adjustment between the temperature and the volume of vapor, in relation to the volume of inert water gas, to bring about just that amount of decomposition of the hydrocarbon vapor that is desirable; and this difficulty is accentuated in those processes (such as the Lowe) where the production of gas is intermittent, and where the surface to decompose the hydrocarbon is heated by the producer gas from the water gas cupola. At the commencement of the gas producing period, when the surfaces are highly heated, there is a tendency to over-decomposition, with the production of soot; and before the end of the period a considerable quantity of the hydrocarbon vapor is not sufficiently decomposed. Only for a period in the middle of the run are the conditions suitable for the purpose aimed at. There is, besides, the difficulty in condensing the very large volume of gas, and separating from it the condensed hydrocarbons, which are in so finely a divided state that they keep floating forward long distances in the current of gas.

These defects are to some extent compensated by the simplicity of the process, the large volume of gas that can be produced on a given space in a given time, and also by the fact that the water gas takes up and

holds in diffusion, volatile hydrocarbons that would otherwise assume the liquid form. If the process discovered by Professor Lewes, for the production of illuminating gas by simultaneously decomposing hydrocarbon liquids and producing pure hydrogen from steam by means of metallic iron, proves as successful as the results obtained at Aldershot would indicate, these objections would be still further removed. Improved results would also be obtained by applying the principles embodied in the Peebles process to that class of processes. Owing, however, to the deteriorating effect of carbonic oxide, due probably to the causes to which I have already referred, the same value in the form of a purely enriching agent will not probably be obtained by any combined hydrocarbon-water-gas process as can be got from the oil decomposed by itself. Besides, from what I have already stated, it will be evident to you that the decomposition of hydrocarbon fluid is far more under control when the fluids are decomposed by themselves.

I have, in my previous papers, on several occasions spoken of the advantages of fractional decomposition and fractional condensation, and I have again to ask you to note the advantages of the application of these principles in the decomposition of such hydrocarbon fluids as are at our disposal. The hydrocarbon fluids, especially such as are used in the production of gas, are never homogeneous. Those at our disposal are the various grades of natural and artificial mineral oils or tars, which are all mixtures of various hydrocarbons, each of which probably requires a different temperature to economically convert it into permanent gaseous compounds. Under such conditions it is very probable that the best results will be obtained by subjecting each hydrocarbon to the temperature appropriate to its gasification with the least amount of deposited carbon. Even allowing the hydrocarbon to be homogenous—say a higher member of the paraffine series—in order to decompose it into gaseous compounds with the least loss it would require to be cracked up in successive stages ; and in order to accomplish that object it is necessary that it should undergo a succession of decompositions. Part is gasified, and the resulting products cooled, so that the condensable matter may be again returned to the retort to be subjected to further decomposition ; the alternate process being repeated till the whole hydrocarbon is resolved into the highest quality of permanent gas, with the smallest deposit of solid carbon.

This fractional method of decomposing the hydrocarbon fluid has the further advantage that the quantity of carbon set free at each operation is small. The large quantity of liquid accompanying the gasified portion washes any accompanying solid carbon back into the retort, and leaves it there in a compact form; and thus one of the greatest difficulties experienced in the decomposition of liquid hydrocarbons containing a large excess of carbon in their constitution is completely overcome, enabling crude tars and tar oil to be converted into illuminating gas as easily as the most refined volatile hydrocarbons.

This now brings us to consider what are the best class of hydrocarbons to aim at producing so as to obtain the largest possible illuminating matter in the gaseous form from a given hydrocarbon. There is no doubt that the constitution of the liquid hydrocarbon employed will have a considerable influence upon that factor in the problem. Commencing with a series of comparatively saturated hydrocarbons, the decomposition can be regulated stage by stage to that desired. It is very different, however, starting with a complex hydrocarbon like coal tar or tar oils containing various groups of hydrocarbons which have already been so altered by heat that the process of converting them into the gaseous form necessarily involves, in the process of cracking, the setting free of a large part of them in the elementary condition of hydrogen and carbon. It has also to be considered whether the resulting products of decomposition are to be rendered permanently gaseous by themselves, or whether the resulting gases are to consist of partially gasified hydrocarbons held in diffusion through water gas.

At a meeting of this Association, held in Edinburgh in July, 1879, I read a paper on the proportion of carbon present in a gas in relation to its illuminating power, which directly bears upon this subject. Attention was then drawn to the relative illuminating power of carbon combined with hydrogen in the form of paraffines, olefines, and the aromatic group of hydrocarbons. It was then shown that by the splitting up of a paraffine into olefines and free hydrogen the illuminating power was largely increased; and, in the same way, the illuminating power of the same paraffine when split up into benzole and free hydrogen was still further increased. But it also shows that the benzole could not be kept in the state of diffusion at ordinary temperatures by the quantity of hydrogen set free in the splitting up process, assuming in all cases no carbon was set free.

Now, the tendency of radiant heat is to split up a complex paraffine into simple paraffines and olefines ; and this process of splitting up goes on till the paraffine is cracked into a series of olefines and the lowest member of the paraffine group, CH_4, which is a very stable compound. On the other hand, we have observed that heat communicated by surface contact to a paraffine has a tendency to produce hydrocarbons of the benzole group.

These observations would indicate that when the hydrocarbon gas has to be used alone, or as an enriching agent to increase the illuminating power of a coal gas, whatever the constitution of the hydrocarbon, the decomposition by radiant heat in free space with a limited amount of surface would be the best method. On the other hand, when the hydrocarbon vapors are decomposed in an atmosphere of water gas, and where time and available space have to be considered, surface decomposition may be more freely employed. With heavy hydrocarbon fluids, however, which deposit a large quantity of solid carbon during decomposition, surface contact cannot be economically employed.

Amongst my earliest communications to the West of Scotland Association was an unfinished paper, left in my hands on the death of my brother-in-law, Mr. Cusiter, of the Dalkeith gas works, who, a short time before his death, had been appointed one of the committee to investigate into the matter of obtaining a substitute for water in wet meters. Amongst the materials tried was intermediate paraffine oil, and he was surprised to find that the oil reduced the illuminating power of the gas to a large extent. Investigation showed that the result was due to the absorption of the volatile hydrocarbon liquids, diffused through the gas by the oil. I have no doubt some of you will remember some of the papers I have communicated on the subject, showing how that observed fact of the solvent affinity of oil for hydrocarbons was turned to the practical purpose of recovering the hydrocarbons from waste gases in the distillation of shale, and also how it suggested improved systems of condensing our coal gas, by which the solvent affinity of the heavy tars were avoided, and a great quantity of hydrocarbon vapors left diffused through the gas, thereby increasing its illuminating power.

That same observed fact is now being applied to and forms one of the principles of producing illuminating gas from mineral oils. As you are aware, illuminating gas produced from mineral oil, owing to the presence of very large volumes of volatile hydrocarbons in the products of decomposition, is liable to be supersaturated with those volatile products, and such gases are liable to deposit their surplus hydrocarbons under the conditions to which they are exposed during distribution. The principle of fractional condensation, in conjunction with the solvent affinity of the oil, when properly carried into effect, completely overcomes these difficulties, and a permanently gaseous compound can be obtained which will resist all climatic and other changes.

There are other points of interest in connection with the principles of the production of illuminating gas from oil, but the time allowed prevents me saying more on the subject to you on the present occasion.

Welded Seams in Plates.

[A paper read by Mr. Warren E. Hill, Vice President of the Continental Iron Works, at the World's Engineering Congress.]

The process of welding together plates of steel or iron to form vessels of various shapes, especially those of cylindrical form, to resist either tensile or collapsing strains, is only recently adopted, and generally accepted as productive of marked practical advantages. But few engineers have had opportunity to become conversant with the practical use of such welded and seamless vessels, or with their advantages over riveted structures, for retaining fluids or gases under very high pressures. The value of shells made up of plates welded together for the boilers of naval and other marine vessels is sure to be more generally recognized and accepted in the near future ; and as a number of stationary boilers having welded shells are now in successful operation, and a locomotive with the boiler shell, furnaces and combustion chamber welded, using a steam pressure of 185 pounds, is worked with the most satisfactory results on the Lehigh Valley road, it seems that it should be of interest to engineers and others to retrace the steps and experiences that led to this advancement in the art of welding iron and steel plates.

Plate welding was practiced more than 25 years ago by Thomas F. Rowland, President of the Continental Iron Works, of Brooklyn, N. Y., who was the first in this country, to the writer's knowledge, to foresee the possibilities and advantages of the art of welding in this respect. At this time the facilities for properly heating plates were meager and inappropriate, yet by creditable skill forgings were produced that were a noticeable advance over previous attempts. One product may be mentioned, and which is now an exhibit at Columbian Exposition in Chicago. This consists of a vessel fashioned after the form of a soda

water bottle, having an interior measurement of 17 inches diameter and 40 inches in length, the thickness being ¼ inch, the bottom hemispherical, and the neck drawn down to 2½ inches. Even at this later date this vessel is regarded as the embodiment and example of a high order of skill in the art of plate welding and forging.

It has been the practice until recently to make the weld in plates with a V shaped or "glut" piece. That is, the edges of the plate to be welded were oppositely beveled, the plate was rolled to cylindrical form, and this cylinder placed seam down on a forge fire of coal or coke, a fire brick being laid inside the seam directly over the fire to retain or store the heat, while, meantime, the "glut" piece, consisting of a bar of round iron, was receiving a welding heat at a neighboring fire. When the cylinder edges and glut were properly heated, the cylinder was lifted by a chain encircling it and running over a sheave carried by a crane, and by porter bars was given a half turn to bring the seam parts uppermost. It was then passed over a bar anvil, the glut was laid in the V formed by the adjacent edges of the plates, and hand hammers were briskly applied to consolidate the parts, a weld of about 5 to 6 inches along the seam being completed with one heat. After one such welding, the glut bar was cut off close to the seam, and the operations of alternately heating and welding were repeated until the seam was finished.

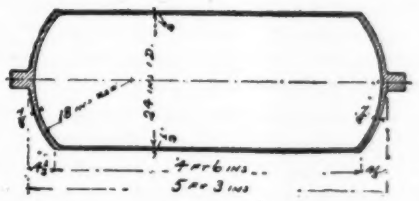


Fig. 1.

The Continental Iron Works first employed welded plates practically in the construction of the boiler furnaces of the United States iron clad monitor "Monadnock, in 1876. These furnaces were 36 inches diameter, and 8 feet 7 inches long and ½ inch thick, each furnace consisting of three cylinders, flanged at their ends, and joined together on the Adamson principle. These furnaces successfully stood the test then made under the supervision of United States engineer officers stationed at the Continental Iron Works; a section of the furnaces inclosed by a jacket being subjected to a collapsing hydrostatic pressure of 450 pounds to the square inch. The weld proved to be perfect, and it is to be regretted that the test was not carried to the point of collapse or destruction, in order that further data of value might have been obtained.

A demand then arose for reservoirs in which to store carbonic acid gas under great pressure. These reservoirs were for use in the "Lay" torpedoes, many of which were built for the Russian and other European governments, several being turned out in the year 1878.

These vessels were of plate iron, ½ inch thick, and cylindrical in form, being 54 inches in length in the cylindrical part, 24 inches inside diameter, and having heads ⅞ inch thick, which were dished 4 inches. The seam along the body and the circumferential seams forming the junction between the body and the heads were made with a glut piece. The heads were of extra thickness, since they had to serve as an anvil while the gluts were welded in the corners. These vessels were subjected to hydrostatic test pressure of 1,800 pounds to the square inch. A steel tape line encircling the cylinder during the test measured the circumferential enlargement, which reached 1¼ inches; and, though the test strain exceeded the elastic limit of the iron, and the stretch remained permanent, yet under this great pressure the welds continued perfect

Fig. 2.

and no weeping at the seams was detected. We were informed that carbonic acid gas was to be stored in these reservoirs at a pressure of 800 to 1,000 pounds to the square inch, and was to be supplied to the propelling engines at a greatly reduced pressure by means of reducing valves.

When steel came into general use, and to a great extent displaced iron because of its greater tensile strength and ductility, it was still the practice in welding the steel to employ a V piece or glut of iron; in fact, it was then considered impossible to otherwise produce a proper weld. In 1885 a water or hydrogen gas plant was erected at the Continental Iron Works, and the use of this gas fuel was a great stride in the advancement and improvement of the art of plate welding. Heats by this gas were quickly obtained, were uniform, and there was an absence of ashes, clinker and dirt. More particularly was the advantage of heating jets which could be applied simultaneously on both sides of the plate by the use of two portable furnaces, gas and air being conveyed to their combustion chambers through flexible tubes in volumes 2½ of air to 1 of gas. The furnaces are supported so that they can be readily thrown in or out of action, and their gas connections are fitted with proper valves convenient to the welder or furnace man, who readily controls the mixing of the gases so as to produce the most effective heats. The cylinder or work to be welded is placed on a tracked carriage with the seam at the top, a fixed bar anvil is arranged in the upper part of the cylinder in line with the seam, and the furnaces in close proximity are located on opposite sides of the seam parts and adjacent to the anvil; thus the time of getting the heated parts over the anvil and under the hammers is reduced to a minimum.

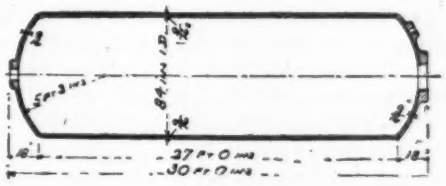


Fig. 3.

The practice of welding with fuel gas soon made apparent the objections to interposing a piece between plates for the purpose, as has been thought necessary, for producing a reliable weld. The essential objections to the presence of a glut in a seam are that there are two welds or junctions instead of one (the two edges of the plate being joined to the two sides of the glut) to resist the strains of the cylinder when under presure, and the objectional necessity of separate fires for the plate and glut bar. The question then arose, Why not dispense with the weld piece or glut, and scarf and join the edges of the plate as a smith would scarf and join bars before joining them by a weld? And so in a short time scarf-welding became the established practice of the Continental Iron Works, the edges of plates to be joined being hammer scarfed or planed to a proper bevel while the plates are flat. In Europe it is common to dispense with such scarfing, either by planing or hammer work, mainly as an economy of cost of labor; and when rolling the plain plates to cylindrical form preparatory to welding, their adjacent edges are left in the position of an overlap, which overlapping parts are, when heated and subjected to the hammers, mashed one into the other. The defects of such practice are that the corners of the plate edges that come in contact with the anvil and hammers immediately lose their heat, and thus an unsatisfactory weld results. The seam of such a weld in a pipe of any considerable thickness will, upon examination, be found to exhibit the result of these defects, and show that the skelp was not scarfed before welding. With a scarf-weld, however, the body of the plate is not cut into, and if desired, the thickness at the weld can be in excess of that of the plate.

In scarfed plate welding, hand and steam hammers are employed, as well as direct acting hydraulic machines, rollers and combined roller and hydraulic power machines. With hammer work there is likelihood of imperfect distribution of work on the weld; one part of the seem may be unnecessarily worked, while possibly an adjacent place would not receive a sufficient number of blows, and blows may be landed where they exercise no useful effect. This uncertainty also is largely true of hydraulic work. The best plate-welding work known to the writer is done by a machine of the combined roller and hydraulic type, embodying an unyielding anvil roller which is on one side of the seam, and a movable roller which is applied to the other side, and which is pressed to its work by hydraulic power of unvarying pressure.

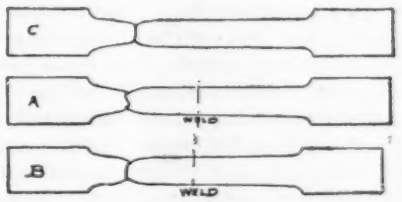


Fig. 4.

This machine consists of two vertically arranged stakes or levers strongly secured together at their base, one of which supports at its upper end the stationary inside anvil roll, the face of which is convexed to the circle of the cylinder to be worked; and this stake also serves as the guide of a cylinder carrying table that is vertically operated by hydraulic power. The other or outer stake carries at its upper end, and opposite

the anvil roll, a laterally working slide block, in which is mounted the outer or movable roll, which has its face concaved to the circle of the cylinder to be welded, and it is in the axial plane of the anvil roller. The heating furnaces are mounted on top of the stakes just above the welding-rolls, the outer furnace being adjustable to and from the other, both being in the same working plane.

The cylinder to be welded is lifted over the inner stake and properly clamped at its lower end to the table, the seam parts being in the vertical line between the furnaces and welding rolls. The gas furnaces are now turned on to heat that portion of the seam located between them, and utilizing an essential advantage in the use of gas furnaces, an intense jet is directed upon the scarfed edges to bring them to proper welding temperature, while a diffusive flame is applied to the parts adjacent to the edges in order that the heat may properly graduate to the cold parts, so as to prevent any injury to the structure of the metal, as would occur by a too distinct line between the heated edges and the cold parts. Having brought the scarfed edges to the desired temperature, the outer welding roll is moved under suitable pressure to contact with the seam or cylinder, which is forced against the anvil roll; the cylinder table is then reciprocated vertically and the heated parts passed between the rolls two or three times, and a weld completed of 6 to 8 inches in length. The welding roll is then released from contact, the cylinder moved so that the portion of the scarf or seam next the weld is brought between the furnaces for heating, and so on, until the seam is finished. With such apparatus a weld is produced that has been subjected in every part to an equally distributed pressure.

A great number of welded boilers of various sizes, known as "digesters," and used for reducing wood to pulp for the manufacture of paper, have been made at these works, and are now successfully operated. Many of them are 7 feet internal diameter and 30 feet over all in length. The limit of width and length in which steel plates can be made at the plate rolling mills necessitates making these vessels from several pieces. In describing these boilers, the welds in the circumferential seams are known by the shop technically as "cross-welds." These boilers in the cylindrical parts are made up of three courses, the plates being $\frac{1}{2}$ inch thick. The heads are $\frac{5}{8}$ inch thick, "bumped" in a hydraulic press to a depth of 15 inches, and are flanged 6 inches deep on the periphery. Before rolling the plates to form the cylindrical portion of the digester, they are beveled in a planer, thus forming the scarfs. The heads when flanged are beveled on a table lathe or boring mill. After welding the cylinders in the vertical welding machine before described, they are clamped together and the cross weld made by hand. These digesters when in use at the paper mills are set vertically, and have heavy rings welded in the top head to form the hole through which the wood is passed to the interior of the boiler, and the lower heads also have rings welded in to form an outlet for the pulp after treatment. The operation of producing the pulp is carried on for about four hours, during which time the pressure maintained is 125 pounds to the inch. Of course, while blowing out the product and refilling the boiler with wood chips the temperature is greatly reduced. These repeated operations cause great strains on the vessels by the action of expansion and contraction, which would soon cause a riveted boiler to leak at the rivets and calking. These boilers, after the completion of welding, are annealed in a proper annealing furnace, and afterward are subject to a hydraulic pressure of 190 pounds to the square inch.

Probably no more severe test can be put to the joint or seam of a welded cylinder than that of corrugating the cylinder to produce a furnace to be used in a boiler. Thousands of these steel corrugated furnaces have been made at these works, and their use in naval and merchant vessels of our country has given entire satisfaction. To the knowledge of the writer, not over a half dozen have failed, and in these cases the failure was in "coming down" or collapsing by reason of a greasy deposit having lodged on their tops, which repelled the water from contact with the metal under great heat. This accident, however, would occur to any furnace under these conditions, even if the metal were several inches thick.

The process of making corrugated furnaces may be interesting. The plate from which a furnace is made is scarfed at its edges, then rolled and welded into a cylinder whose diameter is equal to the mean diameter of the furnace after corrugating. The welded cylinder is then put in a vertical gas furnace and submitted to an even heat, from which it is transferred to a vertical corrugating machine, the corrugating spools of the outer roll of which mesh with and are fed horizontally into those of the inner corrugating roll. After the cylinder has been submitted to the action of these rolls for two or three minutes the corrugations in the cylinder are completely formed, and, by the law governing the flow of metals, the corrugations, notwithstanding the apparent stretching and upsetting of the metal, have an even thickness. After thus corrugating the plain cylinder the circumference of the outer corrugations is $4\frac{1}{8}$ inches greater than was that of the plain cylinder, while the inner corrugations are of a circumference correspondingly less; in other words, the material has been stretched outwardly the distance and compressed or upset the same distance inwardly, making a total range of elongation and compression of $9\frac{1}{4}$ inches. During such operation of corrugating, the weld is severely worked and tested—in fact, by such a test as a smith would put to the weld in a bar by bending it backward and forward to test its perfection. Although these furnaces are all, after completion, subjected to an internal hydrostatic pressure test of 250 pounds to the square inch, not 1 in 50 ever shows a pinhole.

Hundreds of welded shells have been furnished for the Morren or Climax boilers, and many of the Ward boilers, and the Porcupine boilers built by the Hazelton Boiler Company of New York; the steam drums for the United States torpedo boat "Cushing," and numerous yachts, having Thornycroft boilers, built by the Herreshoffs of Bristol, R. I., have been furnished by these works, all proving perfectly tight and satisfactory.

The welded shell referred to as being in active operation on the Lehigh Valley Road is on locomotive known as No. 444, is composed of steel plates $\frac{7}{16}$ inch in thickness, and has an internal diameter of 60 inches. This boiler has a grate surface of 60 square feet, a heating surface of 1,848 square feet, and develops in its general work 900 horse power. This locomotive has been worked up to a development of 1,810 horse power for a period of three hours' duration. About 90 pounds of coal per square foot of grate surface is burnt hourly, the working steam pressure being 185 pounds. This boiler was tested under hydrostatic pressure to 250 pounds to the square inch.

A natural question is, Are welded structures of the kind described as strong at their seams or welds as elsewhere? We will give a single test example that can be taken as the type of many others that have been made, and that could be verified if there were need therefor. A plain headless cylinder was made up of two plate pieces cut from the same commercial plate, which were rolled to semi-cylindrical form and welded together cylindrically, one longitudinal seam being hand-welded and the other being welded by the vertically acting welding machine above described. Three test pieces of uniform size were then cut from this cylinder—one across the machine-welded seam, one from across the hand-welded seam, and one from an unseamed part of the cylinder. These pieces, marked, respectively, "A," "B," and "C," were sent to Fairbanks' Department of Tests and Experiments in New York city, with request that they be tested. The results showed that no piece broke at the weld, or, in other words, each piece broke across its unseamed part. The cut above (see Fig. 4) illustrates these test pieces, and the exact data derived from these tests can be ascertained by a study of the copy of the tabular report that was furnished:

		A	B	C
	Mark	A	B	C
	Test No	9,507	9,508	9,509
	Shape, original	Boiler plate.		
	Shape of test piece	(See cuts.)		
Dimensions. Original.	Length, inches	7	7	7
	Width, inches	1.286	1.280	1.282
	Thickness, inches	0.493	0.523	0.538
	Area, square inches	0.634	0.669	0.690
Dimensions. Final.	Length, inches	8.74	8.40	8.92
	Width, inches	0.900	0.905	0.942
	Thickness, inches	0.289	0.359	0.338
	Area, square inches	0.260	.325	0.318
	Per cent. elongation	24 85	20.00	29.42
	Per cent. reduction	58 99	53.50	53.91
Stress in Pounds Tension.	Elastic limit on specimen	—	—	—
	Maximum on specimen	36,100	39,820	39,530
	Elastic limit per square inch	—	—	—
	Maximum per square inch	56,940	56,970	57,300

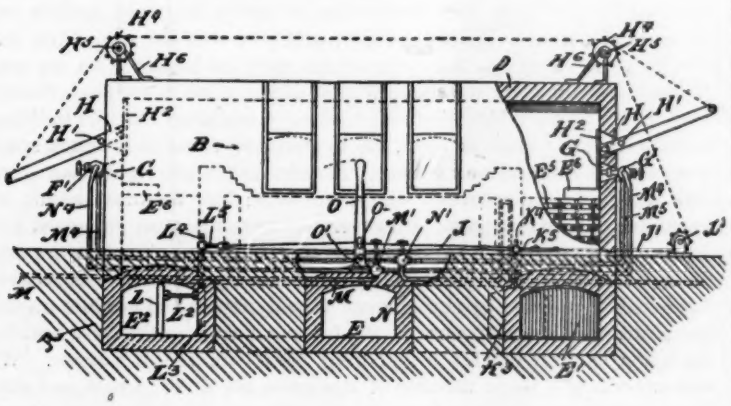
It will be apparent to persons who give even the most superficial attention to the subject of the construction of vessels, for the holding of fluids or gaseous substances under what is generally considered excessive pressure, and also to the production of structures of numerous forms and for various uses, by the process of welding steel plates together, instead of the conservative method of uniting the same by rivets, that the development of this interest, even to the almost primitive state in which it now obtains (and which is only an earnest of what will be accomplished in the future), is the resultant of many years of experiment, thoughtful study, and great difficulties, and also the expenditure of large sums of money without fair prospects of a speedy return thereof. Nearly a score of years were consumed by the persons who, in this country, have steadily pressed the development of this welding industry before anything like fair remuneration for their labors began to be received. Various difficulties other than mechanical difficulties had to

be met and overcome, prominent among which was the prejudice entertained by engineers against welded joints, as compared with those formed by the well known method of riveting and calking. Scarcely any one not familiar with the subject will be able to discern the practicability of making cylinders of considerable size by welding steel plates together for holding high pressure, because, as has been argued, no methods were known by which the integrity of welded seams could be assured, notwithstanding the fact that for a generation past almost every internally fired boiler has been provided with cylindrically constructed pipes or tubes, having welded seams measuring in length from hundreds to thousands of feet, and no engineer questions the integrity of the welded seams of such productions. These pipes or tubes, it is true, were and are welded by machinery, but only in limited sizes, and the efforts of those who have made a constant study of and improvement in this art of welding have been simply to enlarge upon and extend this old method, which has unquestionably been accepted as a perfect but restricted method of producing such structures. For years the limit of the diameter of an iron lap-welded tube or flue was 12 inches; now the production of tubes of 24 inches diameter is a common operation. At the Continental Iron Works it is the common practice to weld up boilers and other vessels of 7 or 8 feet diameter, having a length of from 30 to 33 feet, which diameter and length are only limited by the restrictions of railroad transportation, by the size of the apparatus producing the welds, and by the oven in which the vessels are annealed, for all structures of this nature have finally to be annealed in order to relieve the metal of strains produced by the welding. Many inventions have been conceived and some of them patented in the interest of this business; but such inventions, while important, still indicate but slightly how our long, varied and expensive experience has been obtained, much of which it would be impossible to here set forth so that a person skilled in the arts (which may be germane to the business of welding) could practically understand the same; and therefore such matters have been kept as trade secrets, and their data are not the subject of patents.

In the opinion of the writer, the time is not far distant when the shells of boilers or vessels, similar to those used by our transatlantic steamers and our United States Government cruisers, will all be constructed without the use of rivets or calking. Thus the full advantages of the method may be realized, because, as can be easily proven, the welded portions of the structure are of the same value in tensile strength as any other portion of the material of which the vessel or boiler is constructed. When welded boilers come into more common use, and experience shall overcome the prejudices which to some degree obtain against them, then steam-boiler shells may be lightened in proportion to the difference which common practice now allows as against boilers having riveted joints, for, aside from the weakness of riveted joints, and even with metal of the same thickness as required for riveted work, the weight of butt straps and rivets will be dispensed with.

Wright's Regenerative Oil Burner Furnace.

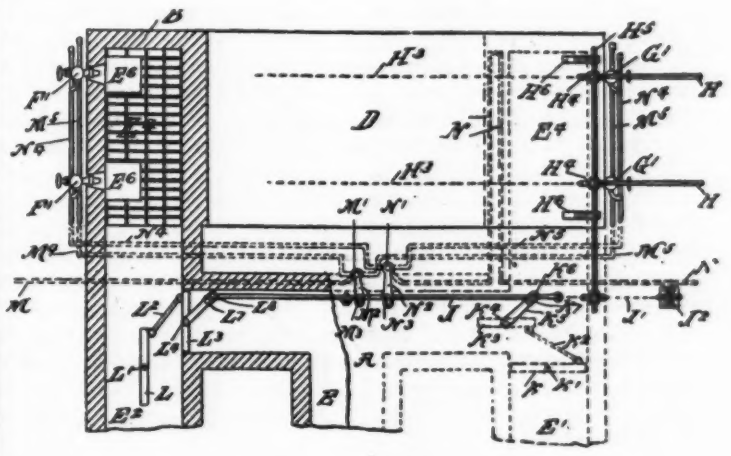
The illustrations show the plan and method of a regenerative steel furnace to be heated by fuel oil, which was devised by Mr. Walter B. Wright, for the purposes of the International Gas and Fuel Company, of Chicago. Figure 1 is an elevation of the furnace at the back partly in section. Fig. 2 is a plan of the furnace partly in section.



E^1 and E^2 are the air flues connecting with the regenerators upon which are laid a series of deflecting plates E^6 E^6, one immediately under each oil burner F^1.

G G are apertures opening into the upper part of the furnace and containing the oil burners F^1 F^1 and G^1 G^1. H is one of a series of similar apertures through which passes the lever H^1, on the inner end of which is the sliding protector-plate H^2, adapted, when raised, to cover the aperture H, and when lowered to cover both the apertures H and G. The internal structure of the furnace on each side is the same. Between each two of these levers H^1 H^1 opposite to each other passes a chain H^3 over the sprocket-wheels H^4 H^4 on the shaft H^5, which is journaled on standards H^6 H^6.

On the platform A, which extends in front of the furnace and over the flue E and the airways E^1 E^2 and their connecting passages, is



placed a longitudinally reciprocating rod J, having at one end the chain J^1, which passes about the sprocket wheel J^2, and thence to the sprocket-wheel H^4. In the air passage E^1 is a valve K, centrally pivoted at K^1 and connected by a link K^2 with the valve K^3, which is centrally pivoted at K^4 at the point where the passage E^1 connects with the flue E.

Keyed to the valve K^3 at the point K^4 is the arm K^5, which is provided with the long slot K^6 to receive the pin K^7 on the rod J. In the passage E^2 is a valve L, centrally pivoted at L^1 and connected by the link L^2 with the valve L^3, which is centrally pivoted at L^4, at which point there is keyed to said valve L^3, the arm L^5 having a long slot L^7, through which projects the pin L^8 on the rod J.

M is a steam supply pipe which leads to the 3-way valve M^1. From this valve projects a handle M^2, provided with a long slot which receives the pin M^3 on the rod J. From this 3-way valve M^1 lead 2 pipes, 1 M^4 connecting with the burners F^1 F^1, and the other M^5 connecting with the valves G^1 G^1.

N is a pipe leading from an oil supply pipe and passing through the fire-wall or supporting-wall of the hearth or bed, and returning thence to the 3 way valve N^1. From this valve projects the handle N^2, having a long slot to engage the pin N^3 on the rod J. From this 3-way valve lead 2 pipes, 1 N^4 to the valves F^1 F^1, and the other N^5 to the valves G^1 G^1.

O is a hand lever pivoted beneath the platform at O^1 and connected by slot and pin at O^2 to the reciprocating rod J.

The advantages claimed for this furnace are as follows: In the ordinary use of open-hearth furnaces, the general structure of which is so well known as not to require any more specific description than is here given, the air or gases are passed through the checker-work in one side of the furnace across the hearth, the supply coming from one side for a certain period, and then the current is reversed. In this latter process the first mentioned checker work will be reheated and air or gases will be drawn through the checker-work at the opposite side, taking up the heat of such checker-work, and this process is continued by successive reversals until the required work has been performed.

With the furnace illustrated it is necessary, first to change the flue or discharge passage from its connections with the two sides of the furnace; second, to reverse the air supply way; third, to reverse the oil flow; fourth, to reverse the flow of steam; and, fifth, to reverse the positions of the protector plates H^2 H^2.

These reversals being made practically simultaneously by means of a lever O from a position where the operator can inspect the hearth. When the parts are in the position shown in Fig. 2 in full lines, a current of air will flow inward through the passage E^2, past the open valve L, and into the chamber E^2, and thence upward through the checker work. In this same position the valve M^1 is in such position as to furnish the flow of steam through the pipe M^4 toward the left and thence into the oil burners F^1 F^1. In this position the valve N^1 is also in such position as

to send a current of oil through the pipe N^4 toward the left into the burners F^1 F^1, the valves being open and the furnace hot, the oil will mix with the steam in the valves F^1 and be delivered thence into the upper part of the chamber E^3, being deflected above the checker-work by the plates E^5 E^5. At the same time a current of air will come up through such chamber from passageway E^2 and through the heated checker-work, being delivered in the form of a highly heated gas upon the hearth.

In the operation so far as described the lever O will stand in the position indicated in Fig. 1. The draft from the hearth is downward through the checker-work E^5 in the chamber E^4, and through the open valve K^3 and into the flue E, and thence to the smokestack. While this process continues, the highly heated gases leaving the hearth will raise the checker-work E^5 to a high temperature. To reverse this action, the lever O is moved toward the left; thus the rod J is moved toward the left and the valve J^3 will be opened and the valve L closed, while at the same time the valve K^3 will be closed and the valve K opened, thus reversing the lead to the flue and the air supply ways E^1 E^2. By the same motion of the rod J the 3 way valves M^1 and N^1 are reversed, so as to send the currents of oil and steam toward the right, discharging through the valves G^1. By this same motion of the rod the chain which passes over the sprocket wheel J^2 and is secured to the spocket wheel H^3, rotates such sprocket wheel over toward the right and raises the plates H^2, which protect the valves G^1. At the same moment by the pull of the chain H^3 the lever H^1 on the left hand side of the furnace is raised to lower the plates H^2, which protect the valves F^1 F^1. Thus it will be seen that the five reversals or changes required are accomplished by the motion of the lever O.

The World's Fair at Chicago.

The American correspondent of the *Journal of Gas Lighting* has this to say about the World's Fair:

It would hardly be expected of the *Journal* to enter into a very lengthy description of the World's Fair at Chicago, for the reason that the great mass of the exhibits would not be of technical interest to its readers. That the mere statement of this fact is not unaccompanied by a pang of regret, must certainly be freely admitted; for it means that, in the greatest exhibition the world has ever seen, there is scarcely anything to indicate the existence of the grand industry to which those who peruse the *Journal* are, in many instances, bound by lifelong ties. It means, further, that, as one traverses those colossal buildings of the White City, he feels as far removed from the gas business as if he were journeying through a trackless forest. For, in fact, there is little or nothing to show that gas is *the* lighting agent of the present day—little or nothing to show how the industry of gas lighting has kept pace with the progress of the world, and how the methods of manufacturing gas and the means of turning it into the active energy which we call light, have developed during the last few years. It also means that, while the visitor enters the Fair with an idea that the heat given out by burning gas is a nuisance, he leaves the grounds carrying that same notion with him, unexploded by a demonstration lesson on the utility of that heat for ventilating purposes; and, finally, it means that advantage has not been taken of the opportunity afforded to show the position which gaseous fuel is now occupying in the domestic economy of the world. When we reflect on this golden opportunity unimproved, and recall the fact that the White City has daily within its walls a hundred thousand persons, it is but natural that we should feel a tinge of keen regret when we say that the Fair is not of technical interest to *Journal* readers. The reasons for this need not be entered upon now—the subject being one of too recent history to make it necessary; but we may say it is due to that spirit which human nature is so apt to encourage—that a matter which is of general interest and value to an industry is not of special interest to each individual member thereof. Hence the great bulk of the gas companies stood aside, conscious that the work should go ahead, but feeling that others should carry it along, or that it was of greater moment to some other company, and therefore should be fathered by those who expected to reap the greatest benefit. Consequently we are brought to see a Fair in which gas has but little part.

To say that we submit gracefully to the inevitable, is a hollow mockery. We do not. As we wander through these huge edifices, which house exhibits from the four corners of the earth, and look at the surging crowd studying and admiring the work of man's hand, we cannot but feel what a great educational scheme it would have been—how far reaching in its effects—if there had been shown here, on an appropriately grand scale, the various uses to which gas can be put, and what an obedient and labor-saving servant it is when properly used in the household, in the shop, and in the warehouse. To have had visitors go home with a right conception of the gas meter, and with a full knowledge of how to obtain the proper amount of light from a given quantity of gas; to have had them see how easy it is to reduce cooking to a science by the aid of gas; to have convinced them, by demonstration, of what an important factor is gas, if properly used in household heating—this was the opportunity open to the gas fraternity, the golden chance which was allowed to pass unimproved. True, we may see an exhibit of the "Otto" gas engine, which is not without merit; and we occasionally observe a gas stove in an odd corner, which, of course, we readily recognize from familiarity with the business, but which the general public would pass, little wondering what it was. But these are of scant value in comparison with what might have been.

When we turn to electricity, however, we are at once filled with the idea of how immeasurably ahead in this regard are our electrical friends, and how completely they have captured the Fair. But when our eyes become accustomed to the glare, and we are able to study the electric exhibit with a discerning eye, we feel that there is psssibly something lacking. That there is electric light in abundance, is certainly true; that, both within and without, the arc and incandescent systems vie with each other in their efforts to decorate and illumine, no one can deny. Yet there is a feeling that something is lacking. What is it? We had the privilege of being at the Fair on the evening of the so-called "opening" of the electricity building, though it had been open for several weeks, and witnessed the grand display of incandescent lights within, and of the arc and incandescent lights without. We were impressed by the capabilities of incandescent lamps for the production of novel effects. The tower of these small lights caused thousands of visitors to stand around and gaze as the operator manipulated the switches, and produced such rapid changes of the lights that the spectators were bewildered by the movements. The spectacle drew exclamations of surprise and admiration from the gathered throng; and it showed fully the capabilities of the incandescent system to produce novel and beautiful effects. And as, later on, we passed out of the electricity building, we again paused, and admired the great possibilities of electricity—for there was the vast artificial lake, with its branching off lagoons surrounded by the graceful buildings, all illuminated with the electric light. On the walls were myriads of incandescent lamps, each doubled by its reflection in the water. Around the buildings were row after row of the same lights. They encircle the domes, and are held aloft in the open hands of the many statues—all showing how effectively electricity can be used to illuminate such a space. The scene was grand indeed; and it was made so largely by the profuse use of electricity.

Yet, as we wandered back through the electricity building, and realized that the edifice was given up exclusively to one industry, the feeling remained that there was something lacking; and we looked for the explanation in no fault-finding or carping spirit. That everything was on a colossal scale, was true; that there were large dynamos, and larger engines, was perfectly apparent. Still, there was a vague sense of disappointment. We had heard so much of this great building, to be devoted, as many supposed, entirely to electric light—so much of the vast sums of money which were being spent to properly represent the business within its walls—that we had looked forward to a visit to the Exhibition as a complete education in electric light matters. We expected to see here, grouped under one roof, all the uses to which electricians all the world over have been able to put this new light; to see it applied to all the various problems of household and domestic economy; and to go home with knowledge whereby we could double our amperes of output. But we did not; and here was the something that was lacking. Perhaps our expectations were too high. If so, we may justly blame the accounts the technical papers gave in advance, though we perhaps should blame ourselves for not realizing that the building is not devoted to electric light, but to electricity; and thus much space is occupied by exhibits of no great interest to electric light managers. This was perhaps a source of disappointment; but, we must admit, an avoidable one on our part. However, we were the most surprised and disappointed in the lack of new ideas and novel machines in the production and utilization of electricity; and our regrets on this score were but partially relieved by seeing some huge dynamos and engines on one bed-plate, with the armature of the former acting as the fly-wheel for the latter, as these machines had long been common in Europe. We saw exhibits of a large number of dynamos all alike in part and size. They looked pretty; but, from an educational standpoint, *cui bono?* Why show twenty or thirty, or perhaps a hundred, machines all alike in workmanship and finish? In other words, why not occupy the space with a greater variety of appliances, and thus make the exhibit of the more educational value, instead of striving to impress the public with

its magnitude? The nature of many of the exhibits gave the discerning onlooker the impression that the exhibitor had obtained more space than he really needed, and was trying to cover the ground. This was the more to be regretted as there are certainly many novelties and a number of uses to which electricity can be applied which are not fully shown in the building, or were not on view at the time of our visit. This certainly was a golden chance for the electrician to demonstrate how this subtle, imponderable power could be applied in the daily walks and vocations of life; to display its many strong points as an illuminator in the house where expense is of little account, and its capabilities for household decoration; and to exhibit this energy harnessed for use in the library, in the parlor, in the dining-room, in the kitchen, in the workshop, and in all the ins and outs of everyday life. This was the opportunity presented; and we do not feel that the occasion has been fully met. A grand scheme would have been to have fitted up a part of this building as a house, and devoted a part to industrial uses, and so have shown electricity employed practically in the daily problems of life. These remarks are not made with the desire to belittle this part of the show. We simply mean that much was promised, and, with the means at command, the exhibit ought to have been above criticism. We acknowledge the big ideas with which our electric friends have carried out their plans; and we admit that the word "big" fits in with the general exhibit. Still, we feel that, in aiming at vastness, novelty should not have been overlooked. As at the time of our visit, all the exhibits were not in place (though they should have been, as the Exhibition had been open many weeks), it is possible that a second inspection may show that the new and the novel are there as well as the massive. An extended description of each exhibit must therefore be deferred.

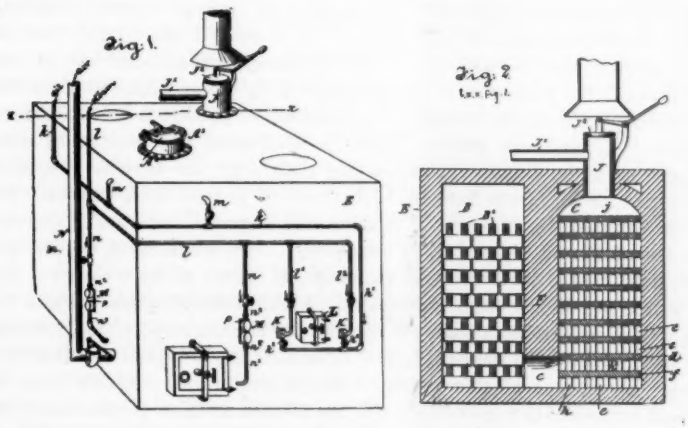
Let us, in closing these comments, impress on every reader that the Chicago Fair is, as stated at the outset, unlike anything the world has ever seen, or is likely to see for many years; and that everyone should visit who can by any means do so. It will well repay a trip across the ocean.

Sutherland's Gas Making Apparatus.

On July 18 U. S. Letters Patent (No. 501,698) were granted to Mr. Alexander M. Sutherland, of Orange, N. J., for an improved water gas apparatus. Using the words of the specification:

The object of my invention is to produce a water gas generator which shall have advantage in cheapness and compactness of construction, and which, at the same time, shall be efficient in producing a well fixed gas enriched by low grade hydrocarbon oils.

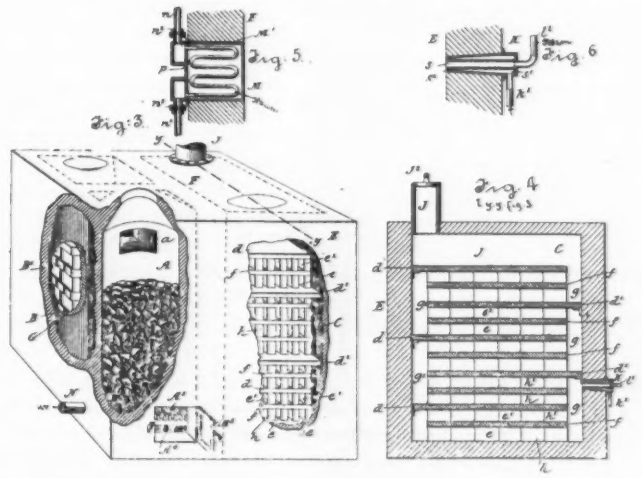
It is well known that hydrocarbons of low specific gravity, while frequently yielding a more luminous and a greater volume of gas from a given quantity than those of the lighter specific gravity, require a higher degree of heat in their transformation than those of the lighter grades of oil.



To obtain the necessary heat for the purpose of obtaining fair results from heavy hydrocarbons by the generator hitherto used, the fixing space has to be raised to so high temperature that a part of the best of the gas is lost during the first part of the run by being formed into "lampblack," while toward its close the temperature is so rapidly lowered that another part of the gas is so imperfectly fixed as to be lost in condensation.

By my invention I provide the fixing chamber with a supplemental hydrocarbon heater or heaters, by which I heat that portion of the fixing chamber which is farthest from the cupola, and by this means, while I am not compelled to raise any part of the generator to such a heat as to be destructive to itself or to be wasteful to both the carbon and the oil, I obtain and maintain an aggregate of such well distributed heat as effects the best results. I also provide the fixing chamber with a series of horizontal flues, and end spaces at front and back joining the flues in sets, so that the gas passes back and forth through the flues, which construction not only gives extensive fixing surface and enables me to make the generator of small dimensions, but prevents radiation and loss of heat, and enables me to uniformly heat the fixing chamber throughout by supplemental heaters which force the products of combustion therefrom through the flues.

In the accompanying drawings Figure 1 is an isometric projection of an apparatus constructed in accordance with my invention. Fig. 2 is a



vertical section of the apparatus taken in the plane x—x of Fig. 1. Fig. 3 is a perspective view thereof with a portion of the casing broken away to show the interior of the cupola and fixing chamber. Fig. 4 is a vertical section taken in the plane y—y of Fig. 3. Fig. 5 is an enlarged detailed view of one of the movable superheaters, and Fig. 6 is an enlarged view of one of the hydrocarbon supplemental heaters.

A represents the cupola, B the primary and C the secondary fixing chamber. These are inclosed by a continuous casing, E, constructed of firebrick or other refractory material, incased in a gas-tight covering, preferably of boiler iron, and are separated from one another by the main partition F, which reaches from the front to the back wall, and the latter partition G, which reaches from the main partition F to the adjacent side wall of the casing.

The cupola is formed at the top with a fuel supply opening, A^1, closed by an exposed gas-tight cap, A^2, and is provided at the bottom with a series of grate bars, A^3, elevated slightly from the floor of the casing, to form an ash pit, A^4, which is closed by a door, A^5. The top of the cupola A is put in communication with the top of the fixing chamber, B, by a flue, a, formed in the partition, G, and in the said fixing chamber, B, are placed refractory brick or tile B^1, cross laid and spaced to form interstices for the free passage of gas down among them to the flue c formed in the main partition F, which connects the fixing chamber B with the fixing chamber C, at the bottom.

Within the fixing chamber C is placed a series of plates or shelves d d^1 of tiling or other suitable material. These are of less length than the length of the chamber, but have the same width, and are set alternately against the front and back walls of the chamber, as shown. The spaces between these plates are divided to form flues e e^1, the division being such preferably as to form two sets of flues for greater subdivision of the gas and to gain greater fixing surface. The division is made by intermediate plates or shelves f, also of tiling or other refractory material, and the spaced tiers of brick h h^1. The said shelves or plates f are of less area than the plates d d^1, and the brickwork and intermediate plates are spaced from the front and back walls of the chamber to form the vertical end space g g^1, through which the gas and also the products of combustion from the supplemental heaters pass from the lower to the next upper set of flues until they reach the top space j, from which they pass through the dome J and pipe J^1 to a hydraulic seal (not shown), and thence through condensers, scrubbers and purifiers to the holder.

The flues e e^1 may be multiplied to any extent desired, or a less number than here shown may be used.

K K represent hydrocarbon burners, by means of which the heating of the flues of the fixing chamber C, at the beginning of the run, is assisted. These burners are preferably of the "steam injector" type, and are each provided with an inner orifice or nozzle s and an outer orifice or nozzle s^2. Through the inner orifice or nozzle s steam is forced when the burner is in operation, while through the outer orifice s^2 hydrocar-

bon oil is drawn by the action of the steam as it issues from its nozzle. In the disposition of these burners, I prefer to arrange them on opposite sides of the door L and at points slightly below the next to the lowermost plate d, whereby to cause them to discharge their flames in the same direction as the products of combustion from the cupola are moving to, thereby not only to apply their heat in the most efficient manner, but also to cause them to aid in forcing such products of combustion through the machine by creating a draft therethrough.

To supply oil to the burners K K, I employ the branch pipes k^1 k^2 which lead from the main oil supply pipe k thereto, while to supply steam to such burners I make use of the branch pipes l^1 l^2, which extend from the main steam pipe l to said burners, as shown.

The main oil supply pipe k is provided with branches m m, which enter the top of the cupola, for supplying the hydrocarbon thereto in the form of a spray for enriching the gas, and the steam pipe l^1 is provided with branches n n which connect with the superheaters M, and from the superheaters extend pipes n^1 n^1, through which the superheated steam is conducted to the bottom of the cupola beneath the charge of fuel.

The superheaters M are fitted in recesses M^1, formed in the walls F and G, adjacent to the cupola to be heated therefrom, and are each composed of a coil of pipe placed therein, the ends of which are connected to the pipes n n^1 by screw couplings or unions n^2, by which the pipes n n^1 may be readily attached to and detached from the inclosed pipe, thus adapting the superheater to be easily taken from the recess and replaced.

Leading to the ashpit below the grate bars is a suitable pipe N, by means of which, and under pressure, air may be supplied in starting.

In operation a fire is first kindled in the cupola, a charge of carbonaceous material supplied thereto, and the air blast started. At the same time the supplemental burners K are started, and the door L and the cap J^2 of the dome J opened to admit the necessary supply of air, and permit of the products of combustion and heat being forced through the flues of the fixing chamber and out into the air. By this operation I am enabled to heat the flues thoroughly and uniformly throughout, and thereby avoid not only the evils of lampblack and the consequent loss of gas, but also the excessive heating of the other parts of the generator. Further than this, when the fixing chamber is thus heated, I am enabled, by the more thorough and uniform distribution of heat, to make longer runs between heatings than with the common forms of generators, and by forming the fixing chamber with back-and-forth flues I obtain and maintain such uniform and well distributed heat in the brick and tilework of the chamber C as to give the best results. When the fixing chambers B and C are thoroughly heated, and the charge in the cupola well ignited, the door L, and cap J^2, will be closed, the airblast and burners K cut off, and steam and oil admitted to the cupola. The steam thus admitted will then pass up through the incandescent material contained in the cupola, and, in its passage therethrough, will be decomposed. The gases resulting from this decomposition and passage through the incandescent material arriving at the top of the cupola will commingle with the products of the combustion of the hydrocarbon supplied at that point and will pass on therewith through the primary and secondary fixing chambers B C, and become thoroughly fixed by the heat therefrom. Having passed through the fixing chambers and arriving at the dome J, the resulting gas will be conducted off through the pipe J^1 as a fixed and permanent gas.

Transporting Petroleum in Bulk

At the meeting (July last) of the Maritime Congress, Mr. F. Flannery handed in a communication on this subject. In the course of his paper the author discussed the various points that arise in the design of tank steamers, and gave instances of vessels that had been built. The chief point of interest was the machinery, whether it should be placed amidships or aft. The question was fairly well discussed at the meeting of the Institute of Naval Architects the week previously, but Mr. Flannery adds some details which are worth quoting. In summarizing the advantages of keeping the engines aft, he points out that the number of bulkheads in a steamer of 7 oil tanks is altogether 12 instead of 14. The weight of shafting through the tunnel is avoided, as is also the weight of the tunnel itself; the oil is contained in tanks that are not divided by the machinery and boilers with their fires. With the engines amidships, the water ballast necessary under the engines and boilers for trimming the vessel is saved; this represents a saving of 250 tons. There is also greater facility for trimming the vessel when loaded with goods other than oil. The doing away with water ballast under the engines aft, to compensate for the weight of coal burnt during the voyage, enables the vessel to arrive at her port of discharge drawing 8 inches less water. That estimate of 8 inches is made without deducting any allowance for extra weight of bulkheads, tunnel and shafting, introduced by placing the engine amidships. These extra weights amounted to 70 tons in the case of a certain vessel to which the author referred, so that a deduction of 2½ inches from the 8 inches would have to be made. In regard to the shaft tunnel, the author points out that it must be of cellular structure, so as to present a double protection of plating between the petroleum and the boiler fires. That would lead to a loss of cargo of 3,300 feet in the vessel referred to by the author, and 700 cubic feet more would be taken up by additional cofferdams. Details of structural strength were also referred to and illustrated by wall diagrams.

In considering the latter, Mr. Flannery had arrived at the following general conclusions: That there must be no lurking places for gas between the ship and the tanks; the oil must come close to the shell of the ship and up to the deck which forms the tank top; 'tween-decks, immediately above the tank top, must be open and accessible throughout, with ample ventilation direct to the outer air; the cofferdam spaces must go right up to the weather deck, and not be stopped short at the 'tween decks; they must be directly ventilated to the open air; the oil tanks must be so shaped that the rising surface of water pumped in to rinse them out shall not be obstructed by carlings, etc., but shall float the oil on the surface right up on to the expansion trunk and to the level of the overflow; each tank should have a separate means of being filled with steam as a preliminary to hand cleansing, and should have the means of artificial as well as natural ventilation, so that foul air may be pumped out and fresh air supplied to take its place. It is only the vapor arising from the petroleum which, when combined with air, forms an explosive mixture. Other considerations tending to safety are also set forth, and the Suez Canal regulations are quoted. At the conclusion of the reading of his paper Mr. Flannery stated that one French and three German builders were now working on their own account in building oil-tank steamers.

M. Daymard referred to a vessel built at the Forges et Chantiers, of which, unfortunately, he had not particulars. The danger of fire, he said, was lessened by the good arrangements made in the English steamers. He quoted some of the relative advantages of machinery in the middle and at the aft end, and spoke of the possibility of petroleum being used in boilers.

Mr. Stephen H. Terry said that he had been associated with the author for some years in working out the matter of ventilation, which was one of great importance in bulk oil steamers. Having turned his attention for some years to the saving of life and property at sea, it had occurred to him that the numerous disasters from explosion, with which the first introduction of bulk-oil steamers was accompanied, could be greatly reduced, if not altogether prevented. Having also had considerable experience in the storage of petroleum under the Mersey Docks Board and the Anglo-American Oil Company, and being aware of the special difficulties of petroleum vapor due to its high specific gravity—some three times that of atmospheric air—he felt convinced that the only proper way to deal with it was on the system adopted for the ventilation of coal mines, in which gases both lighter and heavier than that of atmospheric air are extracted by exhaustion produced by mechanical means. With these general ideas he discussed the matter at some length with Mr. Flannery, suggesting that large air trunks should be provided leading from fans to the bottoms of the oil tank vessels. Mr. Flannery said that the cost of these would be prohibitive, and suggested the use of the oil pipes already necessary. The advantages of the system were that it dealt with the vapor at the lowest point, which was that to which petroleum vapor gravitates. All that was necessary was a fan capable of producing a vacuum of ½ lb. per square inch, which was easily produced by the special type of Chandler fan designed for this purpose. By means of this machine an enormous air velocity was obtained, sufficient to remove through the 10-inch suction pipes some 6,000 or 7,000 cubic feet of air per minute, thus completely changing the air in any one of the ten or more tanks provided in these vessels in from two to three minutes, and capable of changing the whole air in a 4,000-ton ship from two to three times per hour. The speaker thought that, ultimately, the rate of insurance, at present so high, would be reduced, both when carrying oil and when returning with ordinary cargo. This system, the subject of a patent, was capable of considerable modifications for the purpose of ventilating vessels carrying special cargoes. Provision was made for delivering the vapor straight up, or over the port or starboard side as might be desirable.

Mr. Reed, of Lloyd's, stated that his society had paid a great amount of attention to these vessels, and the details had been carefully thought out. Mr. Flannery had been rather hard, he thought, on some of the

early builders of oil tank steamers. Many of these vessels were converted cargo steamers, not being intended for the special purpose, and doubtless the riveting was not as close as it should have been. At present the builders of tank steamers did the work in a most complete and satisfactory manner. In regard to one detail mentioned by the author, he wished to state his opinion that it was a bad principle for oil and water to be taken from the same pipes.

Dr. White pointed out the necessity of captains of vessels being more educated as to the way in which tanks should be used, in order that they might not do those things of which mention had been made in Cardiff last week; such as pumping up ballast tanks at sea in bad weather. The remarkable feature in the petroleum steamers was the ease with which they could now be altered so as to carry general cargo. Everyone knew how, wherever petroleum had been, it left evidence of its presence, and he presumed that special arrangements were made for cleansing. He asked the author what had been done with regard to the use of petroleum for fuel in these tank steamers. He would ask Colonel Soliani, who was connected with the Italian Naval Construction Department, to give his experience on that point. To this request, however, Colonel Soliani did not respond, as might have been expected. The Italian Government has lately carried out very expensive experiments in the use of liquid fuel, and has arrived at very satisfactory results. It is not the practice, however, of foreign navies to communicate these matters, and though courtesy, doubtless, would have led Colonel Soliani to comply with Dr. White's request, his official position prevented him from doing so. He, however, referred to the question of ventilation, pointing out its importance, and saying that Mr. Terry had dealt with it in a very satisfactory manner in his speech.

Mr. Plate, the Chairman of the North German Lloyd's Company, said he was also Chairman of the North Bremen Oil Company, which carried crude oil, a far more dangerous material than refined oil, and the point they had specially to guard against was mixing the two, as a very small quantity of crude oil would entirely spoil the other.

Mr. Flannery, in replying to the discussion, said that the question had been raised as to whether the length of the vessel governed the position of the machinery, and he thought it did not. In designing these ships they had first to deal with safety and then with paying capacity, and it was shown in the paper how these were affected by additional weights from shafting and cofferdams. For his own part he pinned his faith to the balance of advantages in having the machinery aft. He hoped that the Chairman, who was a Director of the Suez Canal, would use his influence in preventing ships from going through the canal that had fires between two volumes of petroleum. As to the burning of petroleum in boilers, he pointed out that tank steamers were in a better position to do this than ordinary vessels, as they went near the refineries. At Batoum they could get refuse almost for nothing, but there were no means of using it, because the vessels navigated salt water. In order to burn petroleum they would have to convert it into a spray; this would consume stean, and water would have to be distilled to replace it. He had been thinking it would be possible to use compressed air for the purpose, for absolutely there must be some means of pulverizing the oil. Experiments had been made in a yacht, but he was not at liberty to give details of these. (In regard to this subject we may say that an oil steamer has been built at Messrs. Armstrong, Mitchell & Co.'s yard, which is fitted with the apparatus for burning liquid fuel by means of compressed air jets, which was designed by Messrs. Doxford, of Sunderland.)

Mr. Flannery, continuing, said that the heat difficulty was one that arose in connection with carrying liquid fuel in the bunker tanks, but that had been got over by water jackets. With regard to the carrying of general cargo in the oil tanks, no difficulty was experienced if proper precautions were taken, and these were of a very simple nature. When the oil was discharged, the tanks were filled with sea water; the oil floated on the surface, and the construction was such that there was no obstruction to the oil rising above the water until it overflowed the tanks. The sea water was then pumped out, and the ventilation, as described by Mr. Terry, took place. When the air was sufficiently pure, men went into the tanks and finished the cleansing by hand, after which the surfaces were whitewashed. A peculiar ceiling was laid down for the cargo to be placed upon. The first cargo that was carried was rice, and this was discharged without a symptom of taint. (We understand that coffee has also been carried in oil tanks without deterioration.) The air pumps, Mr. Flannery said, were kept at work throughout the voyage, to carry away any oil vapor which might generate.

THE Martinsville (Ind.) electric light plant is to be sold at public auction on the 23d inst.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

AT a meeting of the stockholders in the Lincoln (Neb.) Gas and Electric Light Company, held on August 5th, the following Directors were elected: D. E. Thompson, H. J. Walsh, J. D. Macfarland, I. M. Raymond and J. K. Honeywell. At a meeting of the Directors the following executive officers were chosen: President, D. E. Thompson; Vice-President, J. D. Macfarland; Secretary and Treasurer, J. K. Honeywell.

AT a special meeting of the stockholders of the Niagara Falls (N. Y.) Gas Light Company, it was determined to increase the capital stock to $75,000. The present capital is $63,200. The money received for the new issue will be expended in betterments.

THE improvements on the plant of the Elkton (Md.) Gas Light Company have been completed, and the result is a noticeable increase in the quality of the gas sent out.

MR. LOUIS W. BURNHAM, Vice-President of the Electric Gas Lighting Company, of Boston, Mass., died at his home in Dorchester on the 9th inst. He was 62 years of age.

AT a meeting of the Cincinnati Board of Legislation, held early this month, Mr. Bonham's proposed ordinance to establish a gas rate of 75 cents per 1,000 for the city of Cincinnati was reported for indefinite postponement by the Committee on Light. The committee made no presentation of the conclusions that led to the handing in of the report which led to the utterance by Mr. Bonham of some strong language respecting the decision reached. Mr. Mullen retorted in kind, and closed his remarks by intimating that Mr. Bonham was merely agitating this matter for the purpose of securing cheap political notoriety. Mr. Rendigs sided with Mr. Bonham, and Mr. Kistner's contribution to the discussion was in the line of supporting that which the committee had done and indorsing that which Mr. Mullen had said. Vice-President McRoberts explained that the committee had once attempted to effect a compromise with the Company, but that it failed, General Hickenlooper refusing to consider the question with the committee while the very matter was in process of trial at court. The discussion terminated by ordering the Committee on Light to hold the ordinance until the Circuit Court rendered an opinion on the contract price under which the city now receives its supply of gas. The vote was 18 for referring to 7 against. This practically means an indefinite postponement of the matter.

THE resolution favoring the granting of a franchise to the projectors of a Natural Gas Company for Albany, N. Y., which was presented to the Common Council of Albany by its Law Committee, has slumbered peacefully on the table, where it was laid by the Council after its reading. The projectors are now scheming to have the matter removed from its resting place, but the sentiment in favor of "letting it lie" is overwhelming. One of the City Fathers, when appealed to for his views on the likelihood of the franchise becoming operative, said: "No; I am opposed to this scheme. In the first place, the Municipal Gas Company has volunteered to decrease its rates from $2 to $1.75 per 1,000 cubic feet, and the natural gas projectors have no knowledge that such a commodity can be discovered in the district. The Aldermen—or a majority of them—thought it would be the height of folly to grant a franchise to a Company for such an experiment. Even if gas were found it might give out after the pipes were laid and the gas used a short time, and this would not compensate Albanians for the nuisances they would have to bear while the streets were torn up all over the city while the pipes were being laid."

A QUEER claim was that recently put in by Mr. Frederick Bremmer, of Richmond, Va., who asked the Committee on Light to reimburse him in the sum of $20 for 250 lbs. of meat which had been destroyed in his shop by the drip from a gas meter.

AT the annual meeting of the New Bedford (Mass.) Gas and Edison Light Company, the following officers were elected: Directors, Gilbert Allen, Chas. H. Gifford, Samuel C. Hart, H. Hathaway, Horace Howland, David B. Kempton, Geo. F. Kingman, T. H. Knowles, John W. Macomber, Chas. W. Plummer, Chas. R. Price, Wm. J. Rotch and George R. Stetson; Treasurer and Clerk, Charles R. Price.

THE Sargent Gas Machine Company has been incorporated with a capital of $50,000, and its business will be carried on at the Irving Mill, on Central avenue, Westfield, N. J.

MR. V. L. ELBERT has accepted the position of Superintendent of Construction to the Kentucky Heating and Lighting Gas Company, of Louisville, Ky., which concern is now erecting an extensive plant intended to supplement the supply of natural gas during the months of heaviest demand.

JUSTICE COLE, on the 10th inst., gave a hearing in the case of the American Gas Company, of Washington, D. C., vs. the General American Gas and Iron Company, on motion of the complainant, for an injunction *pendente lite*—the initiation of this suit was mentioned in our last. The American Company contracted to sell its plant at the Hygienic Ice Company building to the General Company for 250 shares of the latter's stock, but afterward discovered that the stock was worthless. Justice Cole declined to grant the injunction and discharged the restraining order heretofore granted.

AT a meeting of the City Council, of Davenport, Ia., held early this month, the following ordinance, asked for by the promoters of the Peoples' Gas Light and Construction Company, was offered by Alderman Dickerman. It was read, laid over under the rules and ordered published:

An ordinance granting to the Peoples' Gas Light and Construction Company the right to use the streets, alleys and public places for transmitting gas and electricity, and to sell the same for light, heat, fuel and power purposes in the city of Davenport, Ia.

Section 1. Be it enacted by the City Council of the city of Davenport that permission and authority are hereby granted to the Peoples' Gas Light and Construction Company (hereafter called the Company), its successors and assigns, subject to all rights heretofore granted, to enter upon and occupy the streets, avenues, alleys and public grounds of said city, as the same are now, or may hereafter be laid out, for the purpose of laying pipes, mains, conduits and appurtenances, and the erection of posts, poles, wires and other appliances and fixtures necessary to the business of supplying light, heat, fuel and power by means of electricity and gas, subject to all such reasonable rules and regulations and supervisions respecting the same as said City Council may from time to time select.

Sec. 2. Said Company is hereby granted the right to maintain gas electric light, heat and power plants in said city of Davenport, and to repair, enlarge and extend the same and carry on the business of selling gas and electricity for light, heat and power, provided that private consumers shall never be charged to exceed $1.50 per 1,000 cubic feet for gas, including all meter charges, and electric light at $.....

Sec. 3. Said mains, pipes and conduits for the supplying of gas shall, when practicable, be laid in the alleys, and all posts and poles used in the construction of the pole lines in connection with said plant for the supplying of electricity shall be reasonably straight, placed in alleys when so directed, or adjacent to the line of the curb of the sidewalk, or otherwise in such manner as not unreasonably to impede public travel, to the satisfaction and under the supervision and direction of the Board of Public Works.

Sec. 4. The gas mains or service pipes of said Company shall be so laid as not to interfere with or obstruct the drainage of said city, or the construction of sewers, or the underground pipes or fixtures for the conveyance of water, gas or heat.

Sec. 5. Whenever said Company, its successors and assigns, shall propose to excavate in any street or alley for the purpose of laying down gas mains, or for the purpose of erecting posts or poles, they shall give the Board of Public Works at least two days' notice thereof, and during the progress of their work said Company, its successors and assigns shall not unnecessarily obstruct the streets and alleys, avenues and public grounds, and shall complete each part of the work commenced thereon as speedily as possible, and restore such highway to as good and like condition as before said work was commenced.

Sec. 6. That said Company, its successors and assigns shall hold the city of Davenport harmless of and from any and all causes of action, liabilities and damage, caused or accruing through or by reason of the negligence, mismanagement or default of said Company in or any cause growing out of the construction and operation of its business herein described.

Sec. 7. This ordinance shall be accepted by the said Company under its corporate seal, within 30 days after its final passage and approval.

Sec. 8. The construction of said plant shall be commenced within —— days from the date of the acceptance of this ordinance (but not before said ordinance is accepted as hereinbefore provided), and unless so commenced within the time above limited the rights granted by this ordinance shall be considered forfeited.

Sec. 9. This ordinance shall take effect from and after its acceptance, and shall continue in force for the term of 25 years.

MR. HENRY F. COGGSHALL, President of the Fitchburg (Mass.) Gas and Electric Light Company, has offered to the city, for public park purposes, 40 acres of the hill, valley and meadow belonging to the property owned by him that is known as the Mount Elam estate. He will also convey the right of way to it from several directions.

PROFESSOR RUGGLES President of the Hanover (N. H.) Gas Light Company, has entered into a contract with the proprietors of the Wilder Gas Process Company, of Boston, whereby the latter will carry out an extended experiment at the Hanover works in demonstration of the actual value of the Wilder process.

THE plant and franchises of the Sunbury (Pa.) Gas Company have passed into other hands, and the works are to be rebuilt.

AT the annual meeting of the Woburn (Mass.) Gas Light Company the following officers were chosen: Directors, Benjamin Hinckley, R. J. Monks, John Johnson, C. A. Jones, and O. F. Bryant—the latter succeeds to the vacancy caused by the death of Mr. Gawin R. Gage; President, Benjamin Hinckley; Treasurer and Clerk, R. J. Monks.

As a result of a trial, covering a period of several days, the authorities of Lancaster, Pa., have authorized the Lancaster Gas Light and Fuel Company to light the local prison by gas for the term of one year, beginning Aug. 1.

FROM the report of Superintendent Adams, of the Richmond (Va.) Municipal Gas Works, to the Committee on Light, it appears that in July, 1893, the quantity of gas made equalled 10,871,500 cubic feet, as against 11,214,100 cubic feet in the corresponding month of 1892. The gas consumed in July, 1893, is returned at 11,013,263 cubic feet, as against 11,276,406 cubic feet in July, 1892. The receipts for coke sold in July, 1893, were $875, as against $1,270.25 in July, 1892. The Superintendent believes that the new water gas plant will be ready for operation on or about Aug. 22.

"W. H.," writing from Waterford, N. Y., under date of the 11th inst., says: "It might interest you to know that our village streets were lighted last night by 20 arc lamps, and the service was good. Some three or four weeks ago the taxpayers voted on the question of lighting the streets of the village by electricity, at a cost of $1,500 per annum, or by gas as before, at a cost of $1,000 per year. The decision was in favor of electricity."

IT is said that since the reduction in the gas rate at Woburn, Mass., the consumption has increased to such a degree that Supt. Gilcreast has been obliged to employ an assistant.

WE are indebted to "R. S." for the information that the Niagara Falls (N. Y.) Gas Light Company is extending its mains through Pine street, from Main to Seventh street, thus reaching a section of the town that has been built up greatly within the past few years. Supt. Boore is greatly pleased over the outlook, and the proprietors are also smiling with him.

IT is said that the Laclede Gas Light Company, of St. Louis, earned $38,750 gross for July, an increase over July, 1892, of $3,967. The increase in gross earnings for the first six months of the year 1893, compared with those for the first half of 1892, is returned at $61,225.

WE have been asked to explain the recent marked fall in the value of the shares of the Flatbush (L. I.) Gas Company; and the only tenable reason seems to be the granting of a franchise to the Knickerbocker Electric Light Company. As this last is controlled by the political ring which rules the town, it is not at all unlikely that the proprietors thereof have a more than even chance of securing the public lighting contract, which would mean a marked decrease in the revenue of the Gas Company.

SOME days ago the Committee on Streets of the City Assembly, St. Paul, Minn., recommended the passage of a resolution authorizing the Comptroller to include in the tax estimate for 1894 a sufficient sum for lighting with gas lamps those portions of Summit and University avenues now lighted with gasoline, and also that portion of Rice street, between Como avenue and Front street, which is yet unpaved and is now without mains. The object of the resolution, which has already been recommended for adoption by the Board of Public Works, is to get the St. Paul Gas Light Company to lay gas mains on Rice street before that street is paved. The Gas Company agreed in advance to the proposition, provided the city would agree to light the named roadways with gas. This stipulation on the part of the Company is an eminently reasonable

one, for it is a fact that fully one-fifth of the Company's main mileage is bare of street lamps.

MR. T. D. PETCH, Superintendent of the Eureka (Cal.) Gas Company, has notified the residents that hereafter the gas rate will be $2.50 per 1,000 cubic feet, a reduction of 50 cents per 1,000.

THE Board of Trustees of Alameda, Cal., have adopted the following ordinance to regulate the plumbing trade of that city:

Section 1. On and after the 1st day of September, 1893, no plumber shall work at his trade in the city of Alameda unless he first registers his name and address at the office of the Board of Health. Notice of any change in the place of business of a registered plumber must be immediately given to the Secretary by the Board of Health.

Sec. 2. Every master plumber, before he shall be allowed to register, shall give a bond to the city of Alameda in the sum of $250, with two good and sufficient sureties for the faithful discharge of his duties as plumber, and for the benefit of persons agrieved by his acts or neglect, which bond shall be approved by the President and Secretary of the Board of Health and filed with said Board of Health.

Sec. 3. All applications for registration as master or journeyman plumber shall be made by the party desirous of being registered; and said application shall be subscribed and sworn to by the party making said application on blanks to be provided by the Secretary of the Board of Health, or on substantially the same form.

Sec. 4. Any person violating any provision of this ordinance shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not exceeding $100; and in case such fine be not paid, then the imprisonment in the county jail of Alameda county, California, at the rate of one day for every $2 of the fine so imposed.

It is also provided for that the ordinance shall take immediate effect.

THE Providence (R. I.) *Journal* says that the arbitrators appointed several months ago to fix the price to be paid by the city of Providence to the Narragansett Electric Lighting Company for lighting the streets by electricity have concluded their labors, and hereafter the city will pay 38½ cents per night for each electric arc light furnished by the Company. The arbitrators who had the matter in hand were Gardiner C. Sims, representing the city, and F. A. Gilbert, of Boston, appointed on the part of the Narragansett Company. These appointments were made last November, in accordance with the contract between the city and the Company, executed October 29, 1892, and January 5, 1893. These met and agreed upon the appointment of Francis W. Carpenter as the third arbitrator required by the agreement. Pursuant to the provisions of the contract, the arbitrators met in the Mayor's office in the City Hall, on June 8th, for the purpose of hearing the parties interested. The members of both branches of the Council were invited to be present, and a goodly number were in attendance, as well as the representatives of the Company. The hearing was postponed, however, on request of City Solicitor Colwell, who desired more time for the preparation of the city's side of the case. On Aug. 1 the arbitrators again met in the City Hall for the purpose of hearing any testimony the parties interested might offer, and it was mutually agreed that the matter in issue should be decided by the arbitrators without further hearings. Subsequently the arbitrators carefully examined the subject referred to them, and have individually and together considered the situation and relations of the parties procuring such information as in their judgment would enable them to make a just and equitable award. At a meeting held August 7th the matter was fully discussed and the price agreed upon, as stated above.

A CORRESPONDENT at Los Angeles, Cal., forwards the following respecting the operations of certain capitalists who are attempting to demonstrate the fact that oil in paying quantities exists in the Los Angeles district: "Some weeks ago details of systematic attempts to get oil in paying quantities on land just north of the Second street park lake, were published, and it was also claimed that at least partial success resulted from the attempts. The abundant brea and the exudation of oil on the surface there had been noticed for a long time, but no attempt was made to see what was beneath until Messrs. E. L. Doheney and C. A. Canfield sank the first well there on scientific prospecting and mining principles. At considerable labor and expense they put down a well timbered shaft for a distance of 175 feet. A fine quality of oil was found which flowed at the rate of about six barrels per day. Another well near by was sunk, and recently both wells were sold to Messrs. J. F. Turner and A. E. Rodgers. They are now operating the first well and have also sunk another, and will bore other prospecting holes. The third well is the deepest, being down 220 feet, and is producing fine oil in paying quantity below the level of the first well. The water has not yet been pumped out, but the indications are that it should produce more than the first well. It has gone through ground which the experts say gives the strongest hopes for a good yield. The hydraulic well-boring apparatus has been used, and the oil rises to the surface and flows away. Besides the above operations there are others that are rapidly giving that region the appearance of an embryo oil mining camp. A well has been sunk inside the park by C. F. A. Last and Joseph Bayer to a depth of 227 feet, and they have to put a pump in. The ground is good and oil is being pumped. A gasoline engine is used to run the pump. These parties are drilling another well, and it is understood they will sink eight or ten more prospecting shafts. Mr. Doheney says the ground so far explored will produce oil in paying quantities. Messrs. Doheney and Ailman are now drilling a well on contract in the same locality, and report that the indications are very good. They use a steam plant for the drilling and use oil from the well to generate steam. Several hundred barrels of fine quality petroleum have been produced in the locality above mentioned, and sold, yet the wells have not been pumped to their full capacity."

Choke Damp Effects and their Prevention.

Mr. W. H. Booth, C. E., writing to the *Colliery Engineer* respecting the possibilities of the newly discovered liquefaction of oxygen in saving life in cases where coal miners are exposed to the perils of choke damp, says:

The recent explosion in an English coal pit appears to have been of very slight intensity, whether because of the amount of gas being largely in excess of the explosive proportions, or for some other cause, is not certain. But it appears to have resulted in a large production of choke damp, almost every man in the mine having perished. When we consider the experiments just made by Professor Dewar, in England, upon the liquefaction of air, oxygen and nitrogen, the thought naturally suggests itself: Cannot something be done to ward off the effects of such explosions? Already the converse operation has been carried out. In coal ships the heating of the cargo has been made to cause the discharge of liquefied carbonic acid gas from iron cylinders buried at several points in the mass of coal. When a certain temperature is reached the gas is discharged and permeates the whole mass of coal, and not merely extinguishes any fire which may have commenced, but to some extent reduces the temperature by its expansion, the absorption of heat by the vaporization of the liquid gas requiring much heat which is absorbed from the heated cargo. Moreover, it is said that a heated cargo thus treated does not heat again after this treatment, while if not required, the charged cylinders can be brought home and shipped in a fresh cargo.

When an explosion occurs in a mine it is the after effects which are often chiefly responsible for deaths. Practical men know that the chokedamp will be swept out by the ventilation in a few hours; that a few minutes may make all the difference in certain places between a life-giving and a death dealing atmosphere. A man may be saved by creeping into a lateral opening, while the worst of the fatal stream is swept by him, living upon the small store of air remaining quiescent. Let us suppose such a case, where sudden asphyxiating has not prevented a man from using means of safety—of a man cooped up in a gradually deteriorating atmosphere, but possessed of a bottle of liquid air or oxygen, from which he can let out a small quantity through a narrow opening by means of a screw plug, as usually fitted to such bottles. Would not this man bury his head in the corner of his shelter and cover it with his coat or any piece of cloth that he had with him, and liberate just below his face small whiffs of oxygen sufficient to sustain life till such time as the danger of suffocation had passed? He would not expect in such a situation to maintain a resemblance to the summit of a wind swept mountain or be able to fancy himself on the deck of a ship under reefed topsails, but he might, by careful husbanding of his liquid oxygen, preserve his life perhaps during the one half minute, when alone, the atmosphere around him was unable to do so, for we can never know how great is the proportion of those who are exposed but a short period to gas of absolutely fatal quality, nor how trifling the volume of oxygen necessary to tide over the critical period. The writer has not before him any figures as to the specific gravity of liquid oxygen. Let it be assumed, however, as equal to water, a quart of water weighs about 2 pounds, and the relative weight of water and air is as 800 : 1. Consequently a 2-pound bottle of liquid oxygen, which is but little heavier than air, will expand into nearly 200 gallons; but as air is only about one-fifth oxygen and four fifths inert nitrogen, it is clear that a quart bottle of oxygen in liquid form will represent 1,000 gallons of air, or roughly, 125 cubic feet, equal to a 5 foot cube. But a quart is only a small quantity, and double the amount would not be very bulky.

Doubtless there are difficulties in the way of realizing the idea, and it may prove impracticable, but on the one side we have the fact of hundreds of valuable lives sacrificed for lack of fresh air during a critical and perhaps brief space of time, and on the other hand we have this latest achievement of science, the liquefaction of oxygen. Those who have seen the substance are astonished to see it lie quiescent in an open vessel. A liquid which has required so enormous a pressure to produce is expected to rapidly flash with gas when relieved of pressure. That it does not do so is simply because to become gaseous demands a certain amount of heat, and this cannot be obtained sufficiently rapidly from the surrounding objects, especially if the vessel holding the liquid stands on a non-conductor, as wool. We can scarcely doubt that the liquefaction of oxygen will be utilized in many useful ways, and the saving of life presents one way which is at least worthy the consideration of us all.

The Market for Gas Securities.

The market for city gas shares during the week was without feature, there having been neither sellers nor buyers. Quotations, however, were reported with the usual regularity, but it may be taken for granted that they represented nothing other than the fancy of the brokers who evolved them from their inner consciousness. The number of shares of Consolidated reported as disposed of on the Exchange for the week is put at 1,100, and the range was from 120 to 116. The offered price on the Exchange at the opening this morning (Friday) was 116, or a point over the bid rate. Equitable is offered at 155, and Mutual can be bought at 135. Standard preferred is bid for at 77½. Any of these shares at the quoted rates is a positive purchase.

In Brooklyn securities no change of moment is reported, the market being actually inanimate. Chicago gas was weak and irregular on large transactions. It opened to-day at 49 bid. Well informed parties assert that the dividend for the next quarter will be passed, but we have reason for thinking this belief is a mistake. In any event, holders should remember that the present market rate will likely rule in case the dividend is passed. Consolidated of Baltimore is strong at 50¾ to 51. Within the next fortnight steps will have been taken by the Bay State Company for the arbitration under the Lyford act, and at the bid rate for the common stock (11) the shares look to be a purchase.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

August 21.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	115	116
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	150	155
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	—	135
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	35	40
Preferred	5,000,000	100	80	85
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	110
Citizens	1,200,000	20	—	105
" S. F. Bonds	320,000	1000	—	103
Equity Gas Light Co	2,000,000	100	—	—
Bonds	1,000,000	—	—	60
Fulton Municipal	3,000,000	100	—	120
" Bonds	300,000		102	—
Peoples	1,000,000	10	—	90
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	—	120
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	—	150
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1s Series S.F. Trust	7,000,000	1000	—	60
2d " " "	3,000,000	1000	40	—
Bay State Gas Co.—				
Stock	5,000,000	50	11	—
Income Bonds	2,000,000	1000	40	—
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	49	49¼
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	85	90½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Consumers Gas Light Co., Jersey City	2,000,000	100	—	25
Bonds	600,000	1000	—	85
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	190	191
Central, S. F., Cal			—	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	50¾	51
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
1st Mortgage			85	87

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in a thriving village of about 10,000 inhabitants, centrally located. In first-class order and prosperous condition, with fine opportunity for extension. Address "GAS WORKS,"
950-2 Care this Journal.

For Sale.

One Set of Purifying Boxes,

10 x 10 x 3 ft., with 10-inch Flange Connection Pipes. Also,

One 10-inch Dry Center Seal.

All in good condition. Inquire of
THE NEW BRITAIN GAS LT. CO.,
949-1 New Britain, Conn.

FOR SALE.

Gas Factory,

At Little Falls, Minn.

NOTICE is hereby given that the GAS FACTORY at Little Falls, Minn., with brick building 40 ft. long by 24 ft. wide by 14 ft. high, and Steam Engine, Retorts, Purifiers, Air and Water and Oil Pumps, together with all other apparatus for the manufacture of the Universal Gas, together with Boiler Iron Holder, with capacity of 12,000 cu. ft., and 1,900 ft. of 6-inch, 1,400 ft. of 4-inch, and 70 ft. of 2-inch mains all laid, with Connections and Service Pipes, 300 No. 19 Welsbach Lamps, 30 barrels Gas Naphtha Oil, 20 Gas Meters, with Repairs, Tools, etc., etc.; together with GAS AND ELECTRIC FRANCHISE for the city of Little Falls, also PATENT RIGHT for the manufacture of the UNIVERSAL PATENT GAS, together with the GOOD WILL of the Company, will be sold on

Sept. 5th, 1893, at 2 o'clock P.M.,

by the undersigned, at the said factory in Little Falls, Minn., to the highest bidder therefor for cash.

Each person or party desiring to bid shall, at or before the time of offering his said bid, deposit with the undersigned $500 in cash, or his bid cannot be considered; said $500 so deposited to constitute forfeit money for the faithful performance of the terms of the said bid. Any person desiring an inventory of the property constituting said gas factory and plant may secure the same by application to the undersigned.

Dated Aug. 7, 1893.

CHESTER W. BROWN,
Assg. of Peoples Gas and Electric Co.,
949-3 Little Falls, Minn.

FOR SALE,

Two Ten-Inch Dry Center Seals,

in good condition, and one

Small Multitubular Condenser,

4 ft. diameter and 14 ft. high.

For particulars inquire of FRED. BREDEL, C.E.,
929-tf 118 Farwell Ave., Milwaukee, Wis.

FOR SALE,

An 8-Inch Displacement Exhauster.

Address MORRIS, TASKER & CO.,
937-tf Philadelphia, Pa.

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LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

VALVES,

Double and Single Gate, ¾ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

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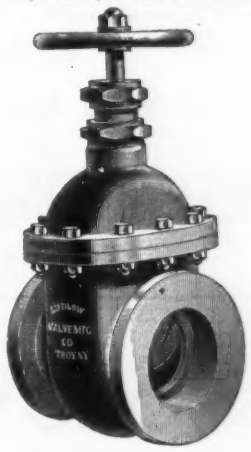

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Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

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938 to 954 River St., & 67 to 83 Vail Av., TROY, N. Y.

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We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

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Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to
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Gas Governors,
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In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters*. The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

Gas Light Companies Can Make Money

by selling our Improved Gas Engines, as well as by the consequent increase in the amount of Gas customers will use. Our Engine is declared by experts to be

"A MARVEL OF SIMPLICITY AND POWER!"

It has absolutely no Springs, no Cog Gears, no Stuffing Boxes, no Valve Stems or Guides, and in fact **No Complications**, yet every part is complete and positive in action and easily handled by the inexperienced. Our Engine entails no Boiler, no Fire, no Engineer, no License, and no Danger. We invite a call or correspondence.

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MANUFACTURERS OF

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Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

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THE GOVERNMENT WATERPROOF PAINT.
Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.
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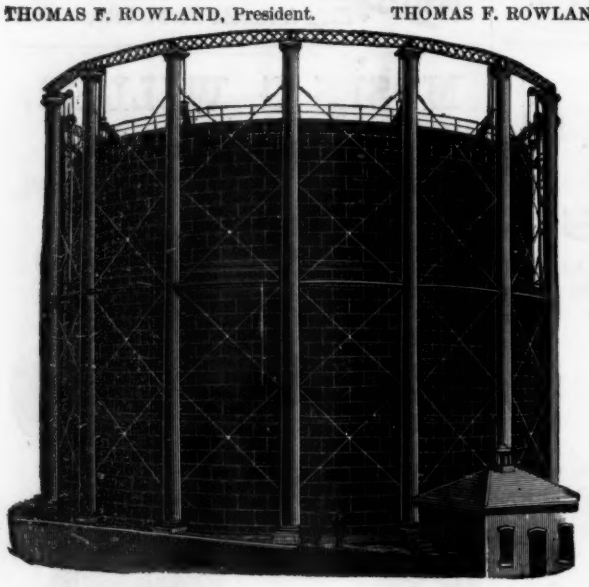

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GAS HOLDERS.
Single and Multiple Section Gas Holders a Specialty.
Wrought Iron Gas Holder Tanks.
BENCH CASTINGS, RETORT LIDS.
Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc., Etc.
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For Round, Oval, or "D" Retorts.

Reliable Gas Stoves and Ranges

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Over 100 . . . . .
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Sole Manufacturers of Reliable Gas Ranges. 479-501 Case Ave., Cleveland, Ohio.

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Eleven Entirely New Ranges.

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71 STYLES,
Listing from 75 Cents to $73.

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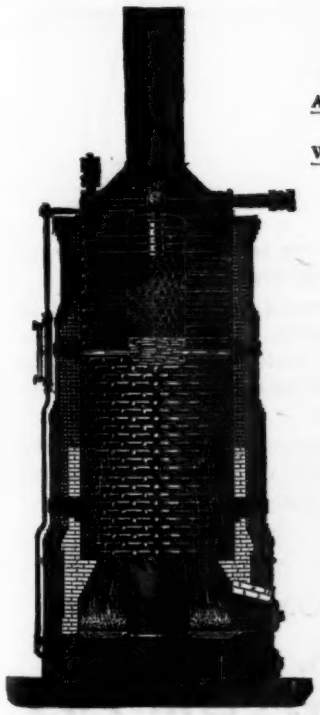
The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

Patented in America and Abroad.



100,000 HORSE POWER

of this Justly Celebrated Water-Tube Boiler in Successful Operation in all the Principal Industries.
An Unparalelled Record, of Over Twelve Years, for Economy, Durability, Safety, and Efficiency.
A Common-Sense High-Pressure Boiler made in a Superior Manner.
We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

THE HIGHEST STANDARD OF EXCELLENCE.

Standard Sizes, 50 H.P. to 500 H.P.

THREE REGISTERED
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THE PORCUPINE BOILER.
TRADE MARKS.

Special Sectional Boilers For Export.

The only Genuine Hazelton or Porcupine Boilers bear our Three Registered Trade Marks.

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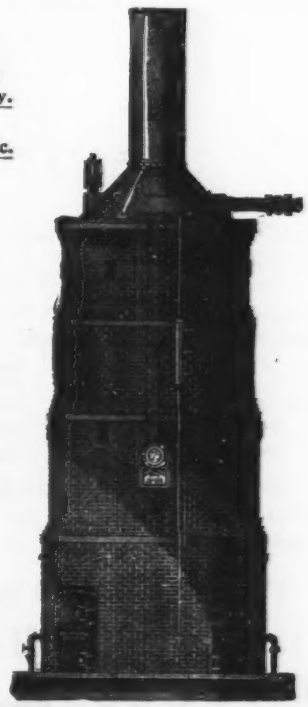
This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.



THE HAZELTON BOILER CO.,

Sole Proprietors and Manufacturers, NEW YORK, U. S. A.

Cable Address, "PAILA," NEW YORK.

WRITE FOR ILLUSTRATED CATALOGUE. Correspondence Solicited.

Long Distance Telephone, 1229-18th St., New York.

This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries.

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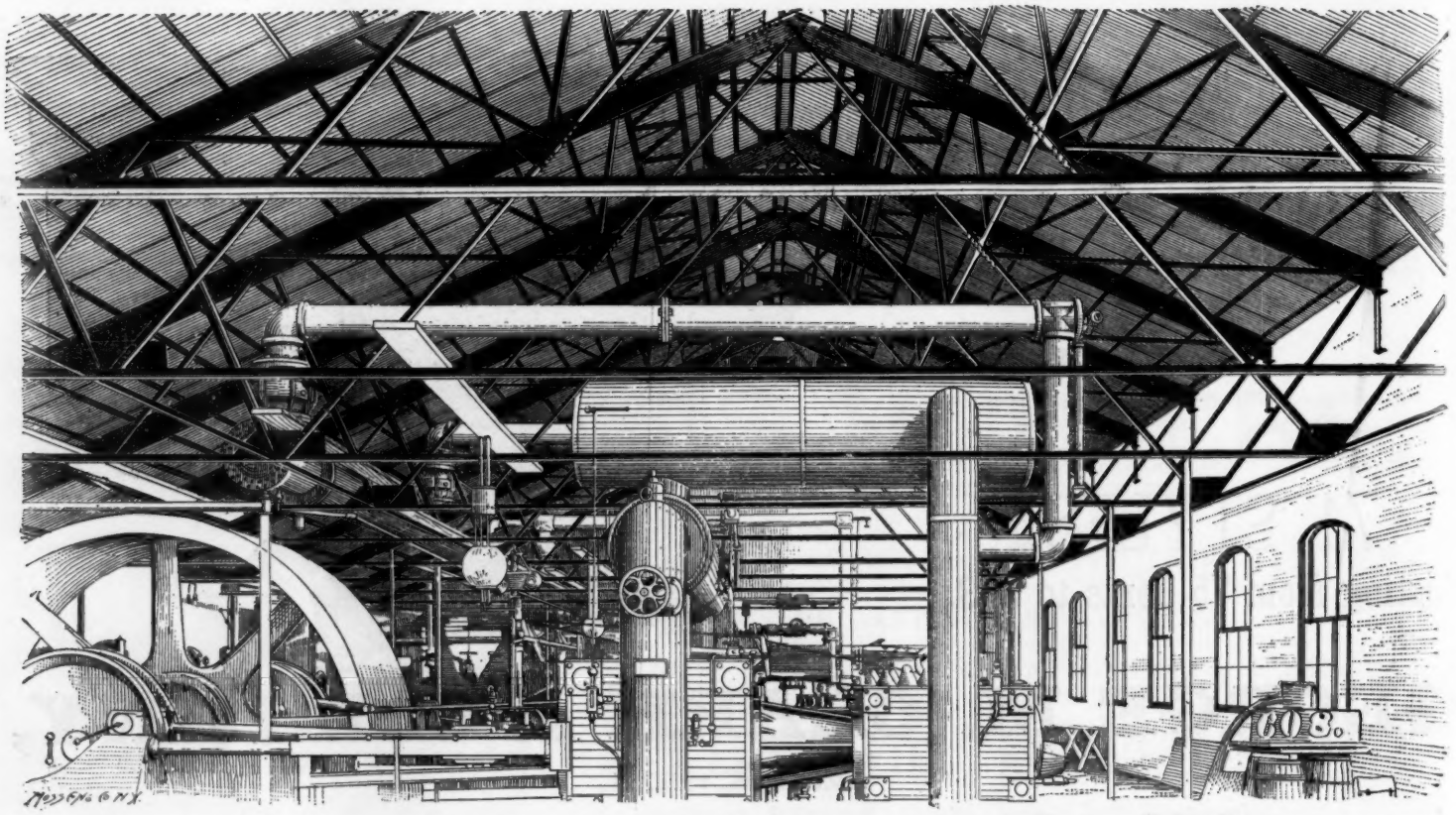
THE BERLIN IRON BRIDGE CO.



The above illustration is taken from a photograph, and shows an interior view of the Engine Room for the Narragansett Electric Lighting Co., at Providence, R. I. This plant is probably one of the best electric lighting plants in the United States. The Roofs of the entire plant were designed and built by us of iron, covered with our Patent Anti-Condensation Corrugated Iron Roof Covering, guaranteed as absolutely fireproof; and we further guarantee that the Corrugated Iron will not drip in the coldest weather.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

HIGH CANDLE POWER

FROM

GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several ests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

	Candle Power.	Pressure.	Gas Consumed.	C.P. per Cu. Ft.
Average of Test No. 1,	67.05	.95 in.	2.6	25.70
" " No. 2,	63.86	1.00 in.	2.86	22.30
" " No. 3,	72.50	2.1 in.	2.87	25.26

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

WE ARE NOW PREPARED TO FILL ALL ORDERS PROMPTLY FOR

HIGH CANDLE POWER WELSBACH LIGHTS.

Gloucester, N. J. WELSBACH LIGHT CO.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved. Price, cloth, $6.

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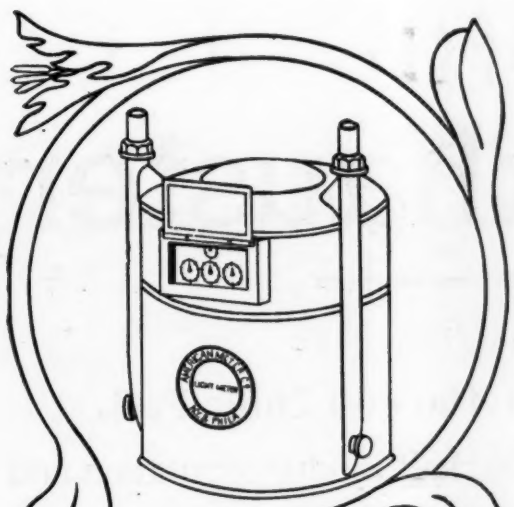

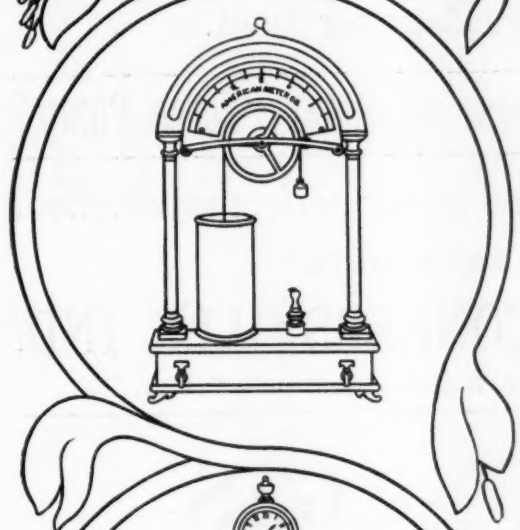

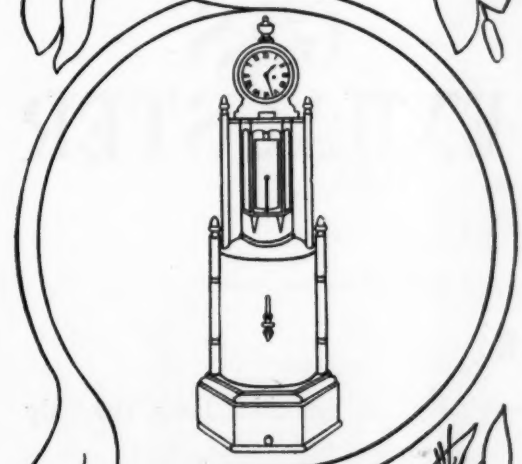

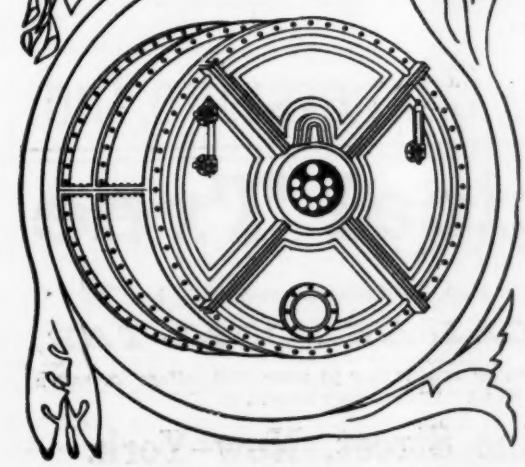

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CHICAGO, CINCINNATI,

ST. LOUIS, SAN FRANCISCO.

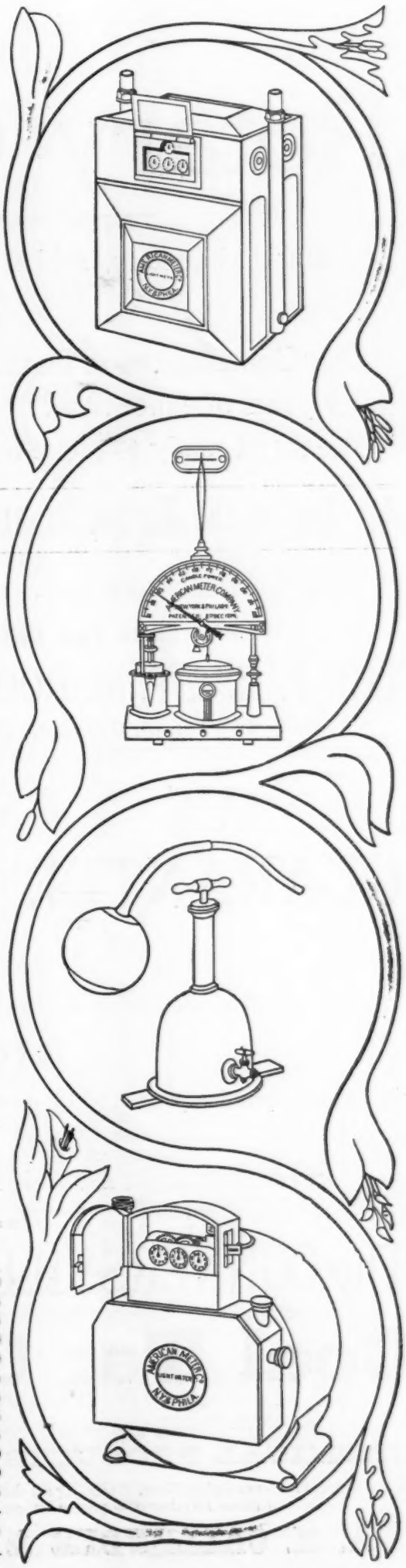
PUBLIC LIGHTING TABLE.

SEPTEMBER, 1893.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. Extinguish.
				P.M.	A.M.
Fri.	1	7.00 PM	10.10 PM	6.30	4.20
Sat.	2	7.00	11.00	6.30	4.20
Sun.	3	7.00 LQ	11.40	6.15	4.30
Mon.	4	7.00	12.40 AM	6.15	4.30
Tue.	5	7.00	1.50	6.15	4.30
Wed.	6	6.50	3.10	6.15	4.30
Thu.	7	6.50	4.30	6.15	4.30
Fri.	8	6.50	4.30	6.15	4.30
Sat.	9	6.50	4.40	6.15	4.30
Sun.	10	6.50 NM	4.40	6.05	4.40
Mon.	11	6.50	4.40	6.05	4.40
Tue.	12	6.40	4.40	6.05	4.40
Wed.	13	6.40	4.40	6.05	4.40
Thu.	14	6.40	4.40	6.05	4.40
Fri.	15	7.40	4.40	6.05	4.40
Sat.	16	8.20	4.40	6.05	4.40
Sun.	17	9.00 FQ	4.40	5.55	4.50
Mon.	18	9.50	4.40	5.55	4.50
Tue.	19	10.50	4.50	5.55	4.50
Wed.	20	11.50	4.50	5.55	4.50
Thu.	21	1.00 AM	4.50	5.55	4.50
Fri.	22	2.10	4.50	5.55	4.50
Sat.	23	3.10	4.50	5.55	4.50
Sun.	24	No L	No L.	5.40	5.00
Mon.	25	No L FM	No L.	5.40	5.00
Tue.	26	No L	No L.	5.40	5.00
Wed.	27	6.20 PM	7.50 PM	5.40	5.00
Thu.	28	6.20	8.20	5.40	5.00
Fri.	29	6.20	8.50	5.40	5.00
Sat.	30	6.20	9.40	5.40	5.00

TOTAL HOURS LIGHTING DURING 1893.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January...	217.30	January...	423.20
February..	200.30	February..	355.25
March	177.50	March	355.35
April.....	160.30	April.....	298.50
May.....	149.00	May.....	264.50
June.....	140.30	June.....	234.25
July.....	143.40	July.....	243.45
August....	154.50	August....	280.25
September.	171.50	September.	321.15
October....	202.20	October....	374.30
November.	221.30	November.	401.40
December.	248.50	December.	433.45
Total..	2188.50	Total..	3987.45



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Our Exhausters, sold from January 1st to August 1st, have

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Our Guarantee as to Durability, Efficiency, etc., is backed by our reputation and thirty years of experience.

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GAS EXHAUSTER

NOW ON THE MARKET.

The attention of Gas Engineers and Manufacturers is respectfully invited to our new

CYCLOIDAL EXHAUSTER,

the internal operating parts of which consist of two Revolvers, each planed accurately on cycloidal lines, the only Exhauster so constructed.

SIMPLICITY * EFFICIENCY * DURABILITY.

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ALTEN S. MILLER, Agent.

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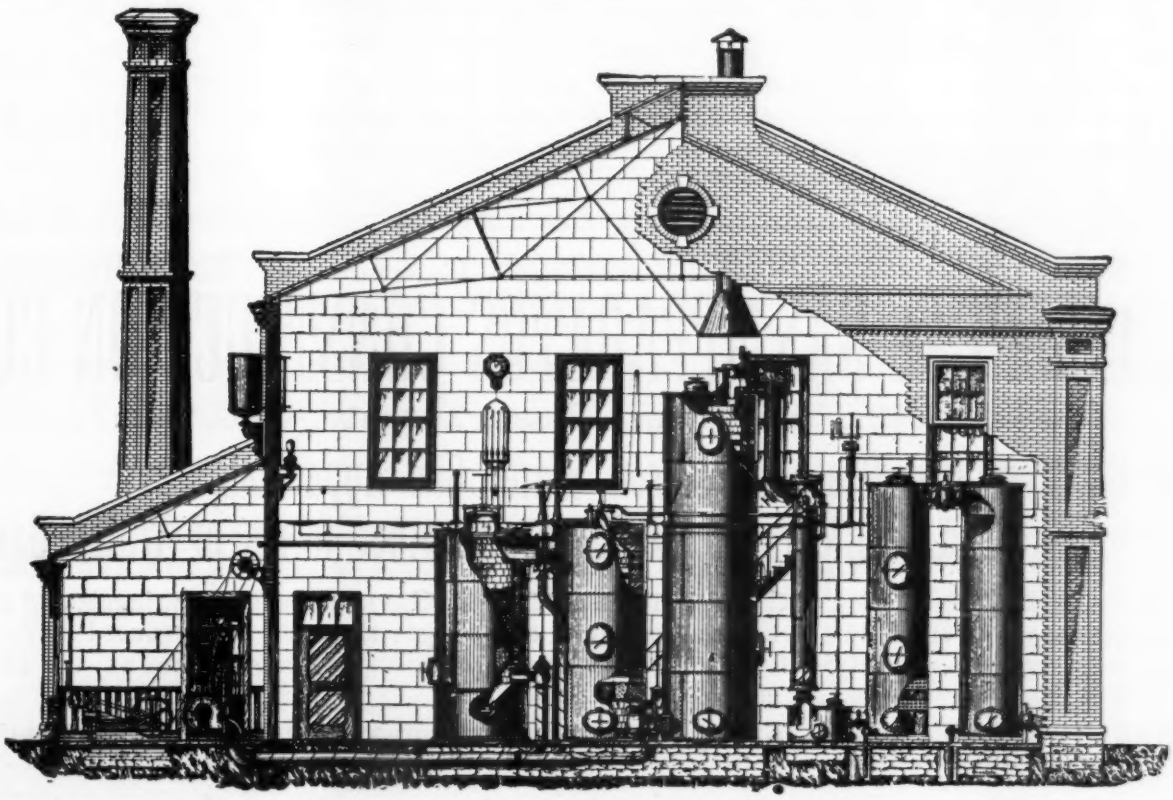
THE STANDARD LOWE WATER GAS APPARATUS.



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It is not the only thing we build, but one of the many things we build WELL, and the near approach of the dark season makes it the most interesting thing to talk about JUST NOW. Therefore WE SAY our installments so far this year aggregate a total daily capacity of 3,800,000 cu. ft. per diem. We think if you are interested, this will warrant your writing us for particulars.

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For Continuous Records of

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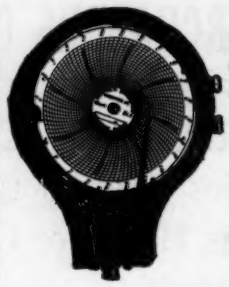

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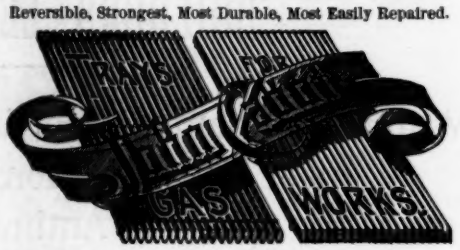

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We also make the Cheapest and Strongest
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STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

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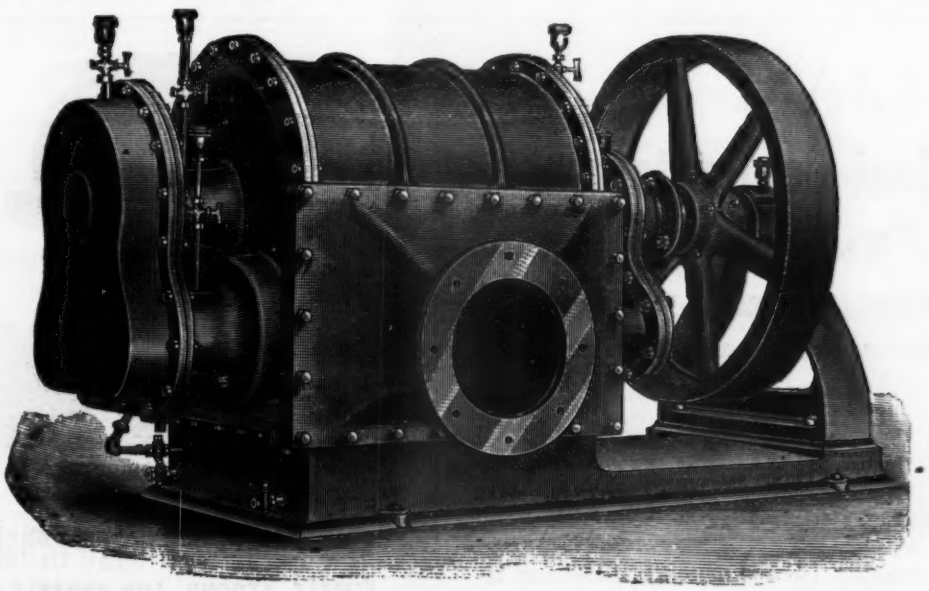

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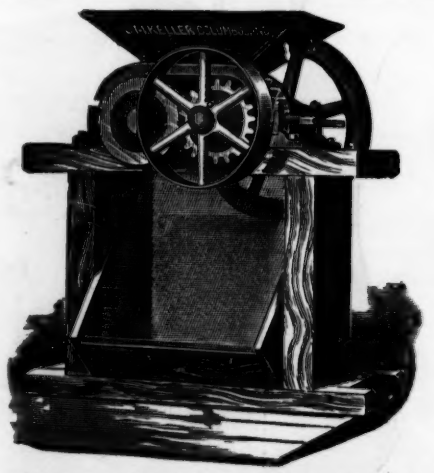

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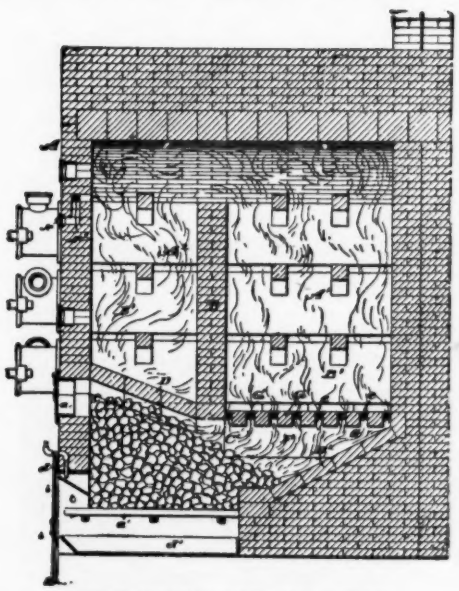

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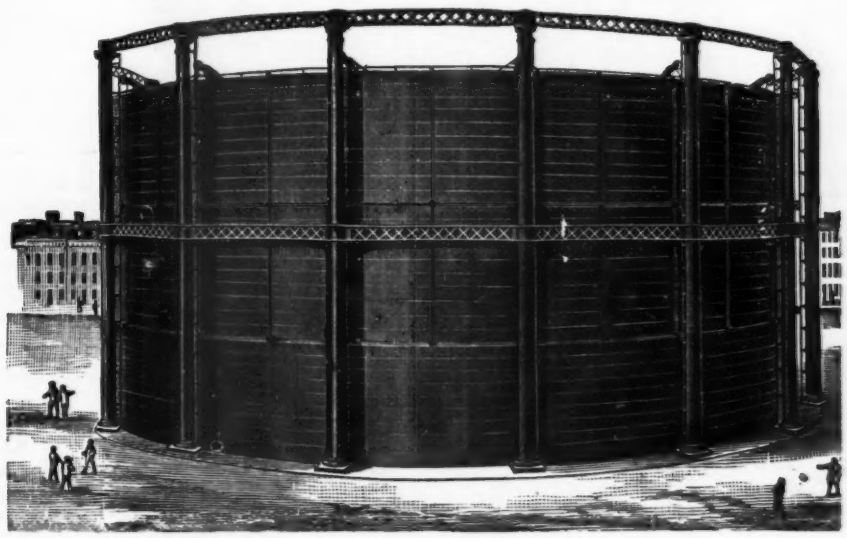

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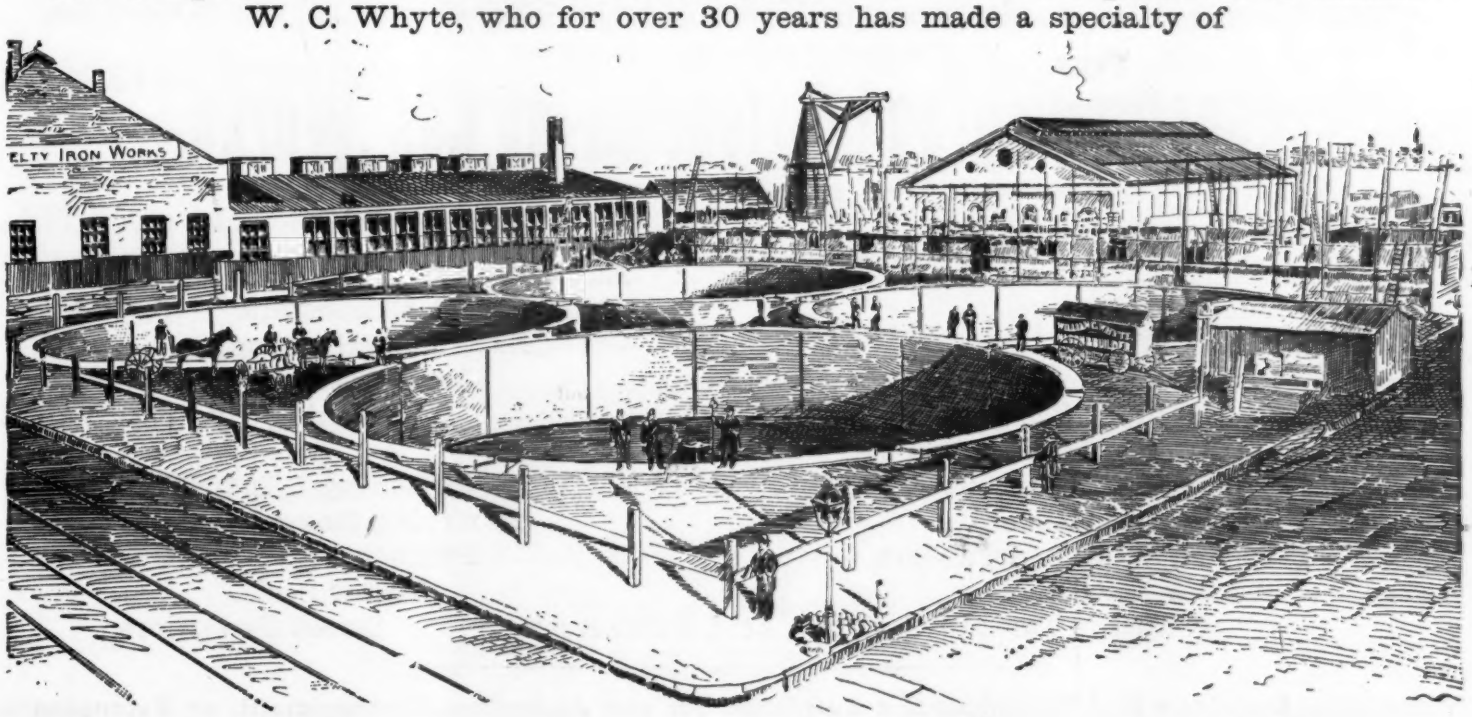

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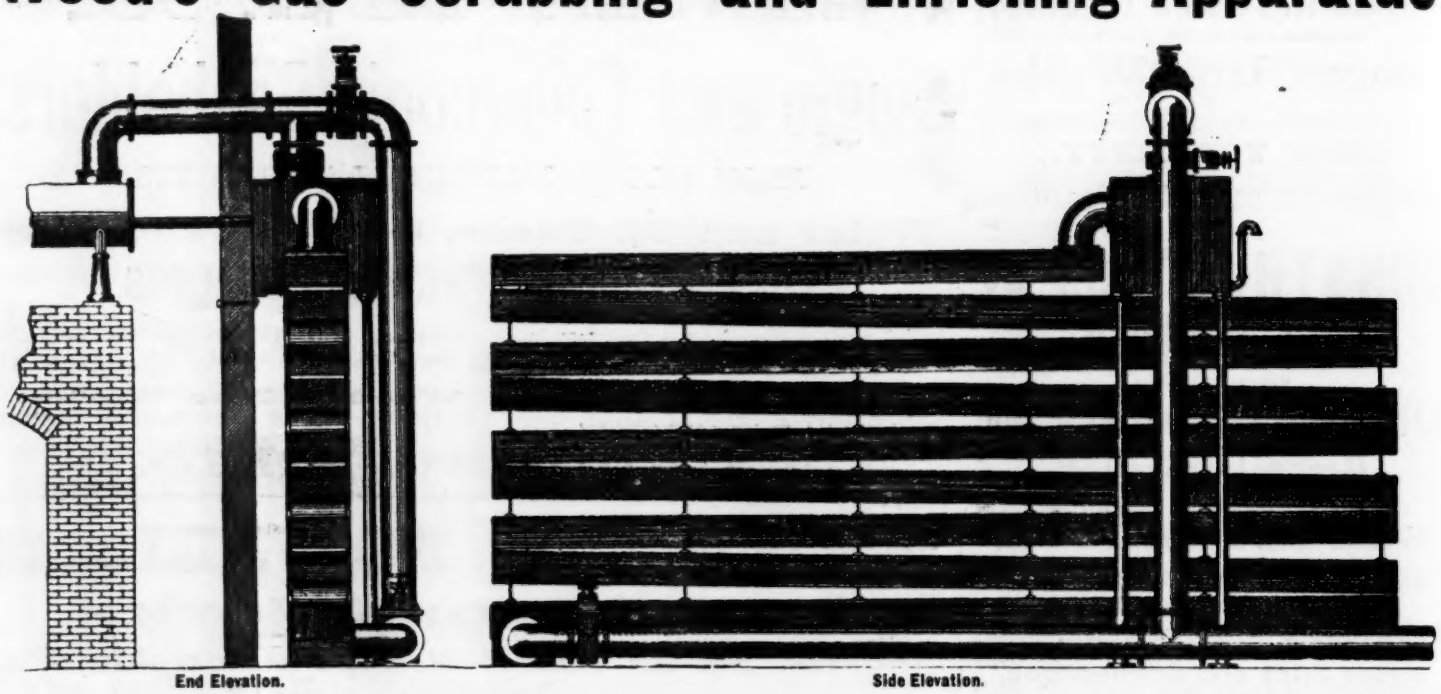

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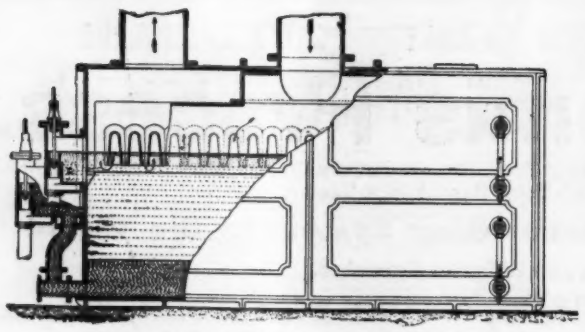

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For the Year 1892.

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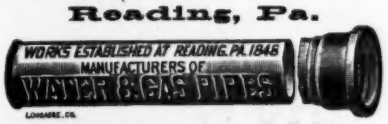

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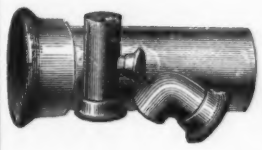

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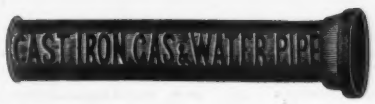

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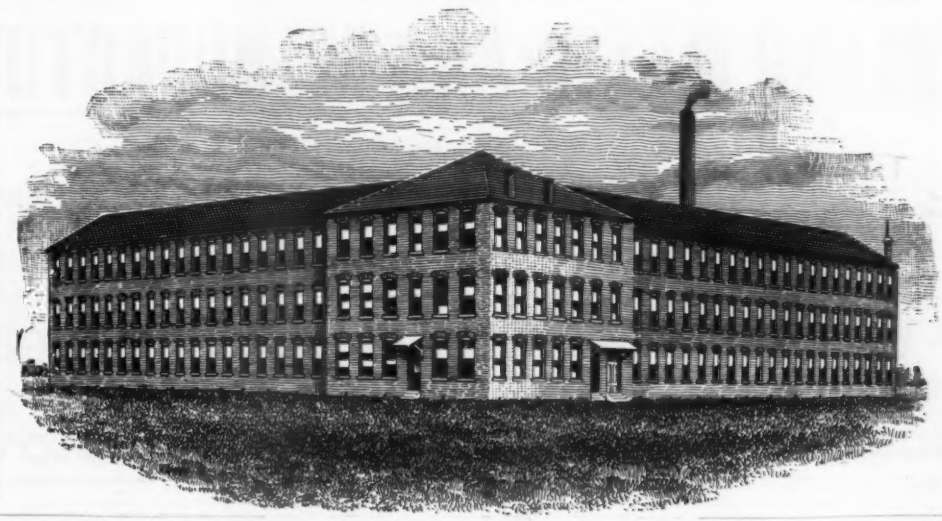

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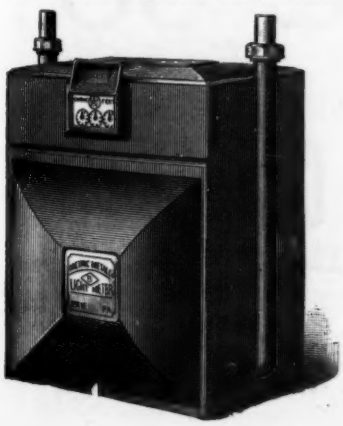

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Mr. Thomas Fletcher, well known in the Gas Industry, gives his opinion on this question as follows

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